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ABSENCE OVER LEAVE IN THE FLEET.

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Absence over leave is so prevalent to-day among enlisted men in the fleet as to seriously injure the discipline and morale of the personnel. If this evil is not checked, and that, too, without unnecessary delay, the efficiency of the service will be disastrously affected.

During one period of five months there were 7150 reported cases of absence over leave among sixteen battleships—more than one case for every two men in the fleet. The average per ship was 447, the maximum was 774 and the minimum 142. Such a record can only be regarded as extremely discreditable; it cannot be passed over without severe condemnation, and the time has come to handle the subject by act and by word in a manner that will command immediate attention and secure immediate reform.

There is not the slightest possible excuse for such a condition. The Navy Department has done all that it could be reasonably expected to do in the interests of enlisted men during recent years, in establishing home ports, granting a free Sunday, and by ordering fleets and divisions to certain ports in order to give leave and liberty from time to time. In fact, the department has been most liberal and consistent in looking out for the welfare and in safeguarding the privileges of enlisted men. Admirals and captains have complied with the general policy of the department by granting the men as much leave and liberty as possible—quite as much

as they have any reason to expect. In many cases the men have had more leave than commissioned officers could get.

REASON FOR THE EVIL.

It is not difficult, however, to account for the prevalence of this offense; it is due to the fact that there has never been any determined or well-directed effort to put a stop to it. In the "Old Navy" it was viewed with comparative unconcern—it was regarded as a necessary evil. The Old Navy bluejacket or marine was not expected to come back on time; if he came back at all he did pretty well—he got a mild punishment, was put down a few conduct classes, confined to the ship as in a penitentiary for three months perhaps, and then granted liberty in a condition, both mental and physical, which inevitably caused him to repeat the offense. In the "New Navy" it is only fair to say that old traditions in this respect have been somewhat modified, to be sure; but the change in the treatment, or view, of this offense has by no means kept pace with the almost complete transformation in the character of the personnel and in the conditions of naval life. The offense is still regarded with more or less indifference and the old-time systems of punishment by "conduct classes" and by restrictions of liberty have been too often perpetuated. Conduct classes never did and never will stop liberty breaking. That system made things easy for the captain, made it unnecessary for him to think. He simply said "fourth class three months," and dismissed the matter. But the men, unfortunately, have done some thinking. They have had every reason to think that overstaying leave is not considered to be a very serious offense; and so they deliberately stay away as long as they choose and whenever they choose, coming back when they get ready to take a nominal or petty punishment or fine, the memory of which soon passes out of mind.

Punishment by courts-martial as now conducted are often of little avail because as a rule the sentences are too mild. A namby-pamby sentence by a court of three young officers who have never themselves been told, and who do not realize that overstaying leave is a serious offense, is not calculated to deter an independent American from taking leave whenever he wants it; and the reading of many such sentences to the ship's company on the quarterdeck does not deter others from breaking liberty—on the contrary such

sentences are an encouragement to liberty-breakers and such "Courts" do more harm than good. Numberless cases of this kind have been noted by the writer. For instance, a man recently overstayed leave nine days, and the court sentenced him to ten days' confinement and to lose $30. The commanding officer remitted the confinement "because the man's services were needed." In other words this man lost $30 for being away about ten days. Many men will gladly pay that price without the slightest hesitation, when they are having a good time ashore or want to stay there for any reason. The publication of that sentence was an inevitable injury to discipline on board that ship. That man, who deliberately stayed away the limit of time, contemptuously indifferent to every sense of military duty and decency, should have been given the limit—thirty days confinement and the loss of three months' pay. The reading of the latter sentence would probably cause some young listeners to gasp for breath, and it might deter them from committing such an offense themselves. Are we to stop punishing men because their services are needed? Are we so helpless as that? It would seem that if the services of a man are of such great value to the ship and to the government, his staying away for nine days should be viewed all the more seriously and his punishment should be the more severe in order to deter him and others from repeating the offense.

Severity of punishment is not cruel in a case of this sort—on the contrary it will usually prove to be a kindness. A jolt in the beginning of a downward career may bring a young man up with a round turn; it may save him, and at the same time it may serve as a splendid warning to others. There are few ways of punishing men nowadays; but all punishment must not be stopped. Bread and water is a simple diet which does no harm, and the contrast with a full ration is rather enlightening. Solitary confinement (provided the term of confinement is not too short) gives a young man a chance to reflect and to realize that he has made a fool of himself at his own expense. If the term is too short, however, the beneficial effect may be entirely lost. The writer has known many cases where punishments which "fitted the crime" have served to put both old and young offenders back on the right tack. Summary and deck courts must work in harmony with the commanding officer, and the latter must lay down the principle in good plain English that certain offenses will not be tolerated; otherwise

the results of such courts will be farcical. An offense will not be considered serious unless it is severely punished.

ENLISTED MEN NOT TO BLAME.

It is not, therefore, the fault of enlisted men that their standard of duty is low as regards absence without leave. They are not to blame. A low standard has been set for them, or they have been permitted to establish their own standard—one or the other. The blame rests elsewhere. Enlisted men will reach the standard that is required of them; if it is set high they will reach it; if it is set low they will naturally descend to it. It is a case of cause and effect. Men in a military service are just what their officers make them—if the latter are competent and determined.

As a result of three years in the training service afloat and two years and a half at Newport followed by nearly two years in command of a battleship I am convinced that the bluejackets recruited during the past ten years have been of such a high average of intelligence that they could be brought to any standard of military efficiency that is reasonable or desirable. It is only necessary for the officers to fix the standard and do their duty in maintaining it; the men will cheerfully recognize the conditions and reach the mark every time. If there is anything wrong it is not with the men—it is with the officers. The latter are not good disciplinarians or good instructors—one or both. The average American boy is so brought up as a rule that he is not naturally military or deferential in his manner, to be sure. But nevertheless it has been conclusively demonstrated at the training station that these lads are amenable to the highest standard of military drill and discipline. Their personal independence is not prohibitive of military efficiency, because their intelligence is exceptionally good and they can readily be made to see the reason for things—they use their brains. They are better than men who are more pliable and less intelligent. The material is all right. It only needs to be properly instructed, strictly disciplined, and fairly treated—that is all. The young American must be started right—that is the whole secret of the matter.

Officers have been heard to complain that their men are not military and not fit for certain duty—and why? Because the officer has not instructed them—he has left them to instruct themselves. It is not commendable for an officer to blame his men for such a

condition—he should take the blame himself and hustle to correct the fault. At the training station all the recruits on a baseball field will stand at attention when the commanding officer approaches. The punctiliousness of the apprentices as regards salutes, etc., has been a subject of wide comment. On the other hand when we come to the fleet the admiral or the captain may pass along unnoticed. Why is this? Simply because the man in the fleet is not taught or required to be attentive and military *habitually* but only *spasmodically*. Spasms are not lasting in effect.

BAD EFFECTS OF LIBERTY BREAKING.

There is no other offense which has such a far-reaching effect for evil in the navy as liberty breaking. It is perfectly plain that it conduces to debauchery and to a general disregard of the fundamental principles of duty—in fact it involves a combination of offenses and it leads men most naturally to a contemptuous view of their obligations to the ship and to the service. On the other hand it will be admitted that if men could be made to recognize in all fairness their obligation to return from liberty on time, the natural effect would be for them to recognize other obligations as well. A careful consideration of this matter will convince any officer that this offense is more generally serious and damaging in its effect upon discipline and efficiency than any other in the category. Furthermore, the effect is rendered still more serious by the fact that our navy is composed almost entirely of young men who are still in the formative years of life; we practically have a navy of boys. If we let them get on the wrong tack when they are young they may remain there; if, on the other hand, we mold them right in the beginning they may stay right; the effect will be lastingly good or lastingly bad. This view of the matter must not be forgotten; it is vital. Our duty as officers is perfectly plain.

In civil trades and corporations men cannot neglect their duty and remain away with impunity. The discipline in civil life, in other words, is vastly better and more severe than it is in the navy in this respect. Our men know perfectly well that such conduct would not be tolerated by any civil employer and that they would lose their jobs if they were at work on shore; but they soon learn that it is the custom or tradition to permit it in the navy, and that they will not be discharged until they have been court-martialed

two or three times. In other words the navy permits, practically encourages, a disregard of obligations on the part of men which would not be tolerated for an instant by the Pennsylvania Railroad or any other corporation; we take and keep men whom they would discharge at once as worthless, untrustworthy and unreliable. As long as the navy regards itself as helpless it will remain so. The condition is one of deep humiliation. An instance is on record—more than one, in fact—of fifty men being absent over leave at one time from a ship at a navy yard. In another case, during a stay of less than two months, eighty men overstayed from one to five days; thirty-two men for five days or over; twenty-seven men one day or less; and seven left the ship without permission—one hundred and forty-six men in all, or about one-fifth of the whole crew. What can we say of a system of discipline under which such a state of things is prevalent, or is possible?

An unfortunate tendency has been noted of late (and officers are more to blame for it than the men) to neglect matters of discipline on board ship if only the spirit of the crew is such that the ship makes a good record at target practice. It is admitted that good shooting is the first essential in the navy, and that the methods by which good shooting was first brought about were demanded at that time—a complete revolution was necessary to fix everybody's mind on a matter that had been so sadly neglected. A general smashing of routine doings, drills, and customs was absolutely proper. But now that this reform has been consummated we need no longer ignore matters of general morale and good discipline. It is not necessary to cater to anybody, nor to cajole anybody into doing his duty now-a-days—we need not seek to create a winning spirit in a ship by letting discipline become lax and by telling men that if they hit the target they will be excused from all or any offenses against good discipline. We can have a high standard at target practice without a low standard of discipline. Any man's place can be filled in this world—even in the navy. "The Lord will provide," even when a gun-pointer is put in the brig.

THE REMEDY.

There is nothing more to be avoided by an officer than a tendency to chronic criticism, growling, and fault-finding. He should not inveigh against a condition until he has investigated the matter and found some remedy for the evil which he thinks he has discovered.

For the past ten years the writer has given special attention and devoted every energy to the general training of men, and particularly to this evil of overstaying leave, believing it to be the most important of all things affecting the navy. The following general plan has been followed both afloat and on shore, and has proved to be conspicuously successful:

(1) The men have been given to understand by frequent warnings in good plain English, with all hands at muster, that absence without leave would not be tolerated—*that it would be punished to the limit of the law in every case.*

(2) Men have not been classed nor restricted to the ship as a punishment for liberty breaking, except when awaiting their turn for confinement—all hands have been given leave and liberty, and as much of it as possible. Extension of liberty and leave have been granted when the circumstances warranted such extensions.

(3) Men not more than three hours over time, who show no intent to remain away, and give some reasonable excuse, get extra duty on the quarterdeck under arms from 8.00 to 11.00 p. m.

(4) Men more than three, and less than twenty-four hours over time get a deck court, as a rule, though in some cases a summary court is assigned.

(5) Men who are twenty-four hours or more over time get a summary court.

(6) The record of the man is always considered, but the general tendency of the courts is to give as severe sentences as the circumstances will justify in all cases, by reason of the liberal privileges allowed, and the utter lack of excuse for such offenses.

(7) Bad conduct discharge is given in case of incorrigibles, or when the man's record justifies it.

(8) Acting appointments of petty officers who break liberty are withdrawn, not as a punishment but for "unreliability."

(9) Permanent appointments are revoked by sentence of summary court-martial.

In addition to the liberal rules concerning liberty, every effort is made to remove petty, harassing, and irritating delays in getting liberty parties out of the ship. As a rule the liberty party is quickly mustered by divisions by petty officers on duty in each division, and these division parties are marched to the dock, formed in line at once, and after counting off by squads the whole party is promptly marched away. It is done in a very few minutes. Thus

the men are not kept standing for a half hour or more while a party of two or three hundred is mustered from a long list by the officer of the deck. These are small matters but they count heavily in securing contentment and in teaching men that their comfort is considered. It is neither military nor sensible to handle a large party of men in any other manner, and an executive officer or officer of the deck is not doing his duty if he permits liberty men to stand around on one leg for a half hour until they are tired out or disgusted.

In this connection it is proper to refer to an order now in force by the action of the commandant of the Philadelphia navy yard. Liberty parties marched through the yard in military formation by an officer wearing a sword, with a petty officer wearing a belt at the head and another at the rear of the column to prevent anybody from joining the party or from taking Government property out of the yard, are passed through the gate without being questioned or stopped no matter what the individual men may carry with them. The navy yard is regarded as a bridge over which the men must pass to avail themselves of the liberty granted them by their commanding officer. This order is the best that has ever been framed, and it is thoroughly appreciated by the men. It is only necessary that the officers on board ship shall do their duty and see that liberty parties are kept closed up and are marched in good order as they should be. Neglect in this particular is inexcusable, and it is from such causes that men have been too often held up, delayed, and searched in a manner that is at once inexcusable and irritating.

This combination of liberal and considerate treatment with a strict requirement as to the standard to be reached is fully recognized as fair and square by the men, and the liberty breaker in this ship gets no sympathy. It is a reasonable concession to American character and at the same time it demands of the independent, self-reliant, headstrong youngster a decent regard for his military duty. It is not necessary to coddle our men nor to yield any military principle whatever. It is only necessary to remember that this is the United States when we formulate systems of discipline, and to tell our men in plain words that the navy is a military service and not a farm. The balance between American institutions and military discipline is easily preserved, and it is the duty of officers to study and know how to preserve it.

In this connection it is proper to refer to the liberal action of the Navy Department and the navy generally in recent years, in abolishing irons, giving men their money, and doing away with the former custom of searching liberty parties at the gangway. These are all concessions to American institutions and American character. It only remains now to make a proper demand of American bluejackets—that they, too, shall do their part by properly recognizing their obligations to the navy and to their uniform. They will come to the mark when this demand is made in an authoritative manner. They have transgressed only because the navy has failed to impress them with the gravity of the offense.

THE RESULT.

The result of the system outlined above and carried out for the past eighteen months on board the *Mississippi* has reduced absence without leave to at least *one-third what it would otherwise have been.* This statement is made with absolute confidence and it could be proved by direct evidence were it not for the manifest impropriety of giving data obtained from other ships. When the efficiency of the navy and the welfare of the enlisted men are involved, however, there should be some means of bringing a subject like this to the attention of the service without danger of giving offense to others, and without subjecting oneself to the charge of self-conceit or improper motives.

The following are some of the results recorded on board the *Mississippi* during the past year:

At Gravesend, England, during a stay of three weeks, only nineteen men returned over liberty; six of these were only two or three hours late, and only four of the whole number were absent twenty-four hours.

At Brest, France, during the stay of three weeks, twenty men returned over liberty, ten of these being less than three hours late and only three being twenty-four hours over time. Not a single man overstayed *leave* during the cruise abroad, although hundreds went to London and Paris. There were two deserters—a suspected thief, and an Italian musician.

From May 8 to June 4, 1911, at Pensacola, Florida, where general liberty was given, eight men overstayed, only three of these for twenty-four hours.

At Hampton Roads in April, 1910, 519 men were given liberty, and thirteen overstayed—one ordinary seaman, two coal passers, one ship's cook, one musician, one mess attendant, a bugler, and six marines. Not a single petty officer overstayed, and only one man of the seaman branch.

At the Philadelphia navy yard from September 7 to September 25, 1911, inclusive, fourteen men overstayed liberty for more than three hours, and only five of these for more than twenty-four hours or longer.

The above is a fair statement of the results obtained under this system. It is proper to state in this connection that it has only been by the constant and unremitting personal attention of the commanding officer that the plan has been a success. A large percentage of the offenders during the past six months have been comparatively new men transferred to this ship to fill vacancies in the complement—men who have been accustomed to some other system. It is not easy for one ship or a few ships to combat an evil of this kind—the whole navy must pull together in a determined manner in order to accomplish a reform which is demanded at once and which should not be delayed. The assertion is ventured that the number of cases of absence without leave can be reduced to one-fourth what it is at present by a firm and consistent system based upon a clearly worded general order that this offense must not be tolerated, and that all offenders shall be severely punished. An additional provision should be made—every man who absents himself for four days should be tried by a general court-martial within twenty-four hours on board his own ship, and sent to Port Royal for at least six months. There should be a court for such purposes on board each ship, and action should be swift and sure.

There will always be a certain number of incorrigibles, but if these men are promptly discharged or sent to Port Royal the number of offenders will soon be greatly diminished, enlisted men generally will settle down to a contented recognition of regulations which are fair and just, debauchery and demoralization will largely disappear, and a system which in the light of the past might appear arbitrary and severe will prove to be simply elevating and beneficent in that it will save many a man from a bad end by bringing him to recognize duty and decency. Procrastination in a disciplinary matter of such importance to the navy will be quite inexcusable; the time has come to do something.

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THE BOARD OF NAVY COMMISSIONERS.

COMMISSIONERS FOR EXECUTING THE OFFICE OF CONSTITUTIONAL COMMANDER-IN-CHIEF OF THE NAVY OF THE UNITED STATES.

By Rear-Admiral S. B. Luce, U. S. Navy (Retired).

Among the most important and responsible duties which can devolve upon the naval officer is that of principal adviser of the Secretary of the Navy on all professional questions. The office comes to him, or should come to him, when his judgment has been ripened by the varied experience of more active employment, and a knowledge enriched by an intimate acquaintance with the needs and all the practical details of the service afloat. The prestige which comes with high rank and the command of a fleet will always prove a valuable asset. Such, in the main, were the Navy Commissioners from 1815 to 1842. They had never commanded fleets, for the simple reason that it was not the policy of the government of that day to create fleets; but they brought to the office the rich experience gained in war—the War of 1812. Such were Commodores John Rodgers, David Porter, Stephen Decatur, William Bainbridge, Charles Morris, Lewis Warrington and others. Three Post Captains, the highest rank of that day, constituted the Board of Navy Commissioners, with the Secretary of the Navy at the head. It is conceded that the navy has never been in such a high state of efficiency as when under the Navy Commissioners (see Annual Report of Secretary of Navy, 1885, page XXVII). In abolishing this board and substituting independent bureaus, it was argued that it was only a change of name from Navy Commissioner to Chief of Bureau, and that the Secretary of the Navy would still have the advice and assistance of the same class of experienced officers. Thus the Board of Navy Commissioners of 1841 was composed of Commodores[1] Charles

[1] Captains in command of squadrons, or naval stations, were given the title, by courtesy, of Commodore.

Morris, Lewis Warrington and John B. Nicolson. The following year, 1842, we find, under the new law, Commodore Lewis Warrington, late Navy Commissioner, now Chief of the Bureau of Yards and Docks; Commodore William M. Crane, Chief of the Bureau of Ordnance and Hydrography; and Commodore David Conner, Chief of the Bureau of Construction and Equipment. This colossal mistake of stripping the secretariat of all but one civilian cost the navy millions upon millions of dollars without anything approaching adequate returns; and, what is far worse, it cost the country the naval prestige won in the War of 1812. For while it is true that the several chiefs of bureaus were taken from the same class of experienced officers as those who had made up the Board of Navy Commissioners, yet they were now assigned to duties which separated them from the secretariat, leaving the civilian Secretary of the Navy in a state of complete isolation. Each separate chief of bureau was taken up with the affairs of his own bureau, leaving the general management of the navy at large to a civilian totally unfamiliar with naval or military affairs. Moreover each Navy Commissioner, when transferred from his military and executive office to his civil office, carried with him by the operation of the law the executive attributes which belong to the secretariat alone. This was a violation of a fundamental military principle, the granting to a subordinate executive powers equal to those of his superior in rank. It is as if a lawyer were put at the head of some great business enterprise for which he has neither training nor aptitude (such as the American line of trans-Atlantic steamers), and the board of directors should be suddenly wiped out, leaving the lawyer president of the company, the sole occupant of his office! Under such conditions it would not be long before the whole business would go into the hands of a receiver. That was the case of the navy from 1842 to and including the year 1889, during which time there was a gradual but sure decadence. The truth of this statement is amply borne out by the annual reports of successive Secretaries of the Navy.

In the annual report of the Secretary of the Navy of November 30, 1889, a table is given of eleven naval powers, showing the total tonnage and other particulars of each. The list does not include the United States. Following the table is the statement of the Secretary that: "the table shows that even when the present building programme is completed the United States

cannot take rank as a naval power." Too true! Towards the last of the "old navy" the decline had been so rapid that under the baneful influence of bureaucracy we had, in 1889, actually ceased to be a naval power! No stronger argument against our present system could be advanced than this one fact!

In 1881 a few far-sighted officers sowed the seed in good ground which germinated, and, in time, brought forth the abundant harvest of a fleet of battle-ships, the first in our history. The question is now as to the necessity of bringing the old navy department up to the requirements of the "new navy," so called.

It has been asserted, and with some show of reason, that a naval officer of rank and experience should be placed at the head of the navy. President Madison offered the position of Secretary of the Navy to Commodore Rodgers, who declined the honor. Again in 1818 the office was offered him, and again declined. President Tyler offered the secretaryship to Captain Robert F. Stockton, U. S. N., who declined it. The practice of the English navy in this respect has been pointed to as an example that might well be followed. This position is wholly untenable. The First Lord of the English Admiralty, equivalent to our Secretary of the Navy, is taken from civil life; but whereas the former has a seat in Parliament and can advocate in person on the floor of the House the adoption of a given naval policy, the latter has to communicate with Congress in writing which very few read. The English Admirals who a century ago became First Lords were, for distinguished services, elevated to the peerage, and in consequence took their seats in the House of Lords, or were elected by their constituents to the House of Commons. This gave them valuable experience in public affairs and an intimate acquaintance with the leading men who controlled the foreign policy of the state, advantages denied American naval officers. Of this class were Admirals Lord Anson, Sir Charles Saunders, Sir Edward Hawke, Lord Keppel, Lord Howe, the Earl of St. Vincent, Lord Barham and others. Each and all had been created peers for distinguished services in their profession before being called upon to preside over the affairs of the English navy as a Minister of State; or had a seat in the House of Commons. But naval officers are not fitted by training or habits of thought for making good Ministers of State. This is well illustrated by the experience in England. Following the execution of Byng, March 14, 1757,

Pitt during a heated debate severely criticised Admiral Lord Anson, "the late First Commissioner of the Admiralty." But later, when the storm of passion had subsided, he spoke of him as "the greatest and most respectable naval authority that ever existed in this country. . . . To his wisdom, to his experience and care the nation owes the glorious naval successes of the last war. The facts laid before Parliament in the year 1756 so entirely convinced me of the injustice done to his character that in spite of the popular clamors raised against him . . . I replaced him at the head of the Admiralty, and I thank God I had the resolution to do so."

Coming, as it did, after mature reflection, and considering its source, this is certainly high praise. But "Chatham's posthumous eulogy," according to Captain Montagu Burrows, R. N., "is more than offset by the opinion of a sensible man like Lord Waldegrave." "Lord Anson," said he, "was in reality a good sea officer, but nature had not endowed him with those extraordinary abilities which had been so liberally granted him by the whole nation." This judgment, observes the author of the "Life of Lord Hawke," has been confirmed by the great authority of Lord Stanhope.

The Earl of St. Vincent, in a letter to Lord Keith announcing his (the Earl's) appointment as First Lord of the Admiralty, writes: "How I shall succeed remains to be proved; I have known many a good Admiral make a wretched First Lord of the Admiralty"; and it is supposed, and with reason, that he alluded to his predecessors whose names we have given. St. Vincent himself proved no exception to the rule. Sir James Graham, a civilian, who had served in two administrations as First Lord of the Admiralty and who was evidently partial to naval officers in general, said: "I regard Lord St. Vincent as one of the greatest of our naval heroes, and, in his own element, almost unrivaled in history. I have read the debate, when Lord St. Vincent was First Lord of the Admiralty, in which Mr. Pitt, after the peace of Amiens, discussed the naval preparations and defences generally of this country, and made a motion for inquiry which Mr. Fox supported, and I find that by almost universal consent at that time Lord St. Vincent's administration at the Admiralty was condemned, he being certainly in his own element one of the greatest of naval commanders."

And yet, notwithstanding all the animadversions, it may be truthfully affirmed that the improvements inaugurated by Lord St. Vincent when First Lord of the Admiralty in 1801-4 laid the foundation of the triumphs of Lord Nelson in 1805. "Lord St. Vincent, whose ideas on naval strategy were clear and sound, though he did not use the technical terms of the art, discerned and provided against the very purpose entertained by Bonaparte of a concentration before Boulogne by ships drawn from the Atlantic and Mediterranean."[2]

Of Admiral Lord Keppel it was said that, when First Lord of the Admiralty, he allowed his personal animosity to Lord Rodney to get the better of him so far that he recalled Rodney from the command in the West Indies in "a manner the least considerate and most summary that can well be imagined." It so happened that the order for his recall from the West Indies crossed the despatch bearing Lord Rodney's account of his victory of April 12, 1782, over the French under de Grasse. It is assumed that such professional jealousy would be out of the question with a civilian First Lord. However that may be, it is conceded that in the English navy, at least, the weight of evidence is decidedly in favor of a civilian to preside over the navy; but it stands to reason that such civilians must have professional counsellors. Sir John Barrow, Secretary of the Admiralty during many years, and author of the lives of Lords Anson and Howe, in treating with great ability the question whether naval men or civilians make the best First Lords, finds in favor of civilians, and Captain Burrows, R. N., in his "Life of Hawke," asserts that: "It will not be found easy to dispute his position"; but he adds the proviso: "If you can get the right kind of naval man for First Lord, put him in." Sir John Barrow sustains his views in favor of a civilian First Lord, first in the certainty that naval First Lords will show a partiality to those who have served under them, and secondly, their want of the general knowledge necessary for a mixed position, half naval, half civil. The civilian First Lord assisted by naval men is his ideal; and the custom of successive administrations has followed that direction.[3] He might

[2] Mahan: Sea Power, French Revolution. See also "Naval Administration," by Sir Admiral Vesey Hamilton, R N., p. 14.

[3] Sir John Barrow was appointed Secretary to the Admiralty in 1804, where he served with slight intermission for forty years, and under twelve different naval administrations.

have added that naval First Lords are not always above wreaking their vengeance on their enemies of the profession, as in the case of Admiral Lord Keppel.

The queston of having a naval officer for Secretary of the Navy may be dismissed forever from the public mind.

From the experience of the greatest naval power of the day we are led to conclude that a civilian Secretary of the Navy assisted by a board of naval officers is the main point in a naval administration that will stand the test of a great war; all the rest being subsidiary.

It is the duty of the Commander-in-Chief afloat to do the best possible, under instructions from headquarters, with the forces and facilities given him; but it is the duty of the naval administrator (the Secretary and his advisers) to see that that force is adequate to any occasion that may arise. On him devolves the duty of utilizing the resources of the country to the best advantage; of keeping the fleet well supplied at all times with men, provisions, and supplies of all kinds and munitions of war; and of devising such military measures as may most directly tend to the successful termination of a war. As in time of war there may be, and probably will be, two or more fleets or squadrons operating in different spheres of the theatre of war, not only their general management but their concert of action demand that at the directorate there shall be professional abilities of the highest order. The Trafalgar campaign may be cited once more, not, as on former occasions, for its lessons in strategy; but, this time, as an example of the vast and responsible duties which, in war, tax to the utmost the efficiency and resources of a given form of naval government. The problem presented to the English Admiralty was to prevent the invasion of England by Napoleon. To this end Admiral Lord Keith with eleven ships of the line was stationed, at one stage of the campaign, in the Downs to watch the Texel and the Straits of Dover. Cornwallis, blockading off Brest with from twenty to twenty-four ships, formed the center of the British line. Pellew, off Ferrol with eight ships, watched the combined fleet of fifteen. Collingwood was off Cadiz with eight ships. Nelson was off Toulon with twelve ships. In the West Indies were four ships of the line. All these varied stations were linked together by a chain of from one hundred to one hundred and fifty smaller vessels. The positions and strength of

these various detachments were changed from time to time as the exigencies of the war required.

The blockade off Brest won the admiration of the world for its rigidity and constancy. As to supplies, Admiral Pellew wrote: "I can assert with confidence that our navy was never better found, that it was never better supplied, and that our men were never better fed or better clothed." Here we have an ample evidence that the commissariat—the civil branch of the Admiralty—was thoroughly efficient, and the successful issue of the campaign, due to the skilful disposition of the ships, furnishes abundant proof that the military branch was equally efficient; and further, that the two parts worked in harmony, as one well-organized body. In short, the British Admiralty stood the test of a great war. It is a wonderful and instructive story of efficient naval administration—this Trafalgar campaign.

The readiness and the ability to devise a strategic plan of operations in advance of hostilities is one of the first essentials of a sound system of naval administration. An able military writer of our own day, in advocating a close study of war as a science, remarks that:

> We want to know, not only the best means and methods of conducting all the various operations of war, including the preparations therefor, but also, as far as possible, to clearly perceive all the conditions of the problem of war; to be able to analyze and combine those conditions; to estimate the character of the work to be done and the means necessary to attain that end; to measure, accurately, the means at our disposal, the best practicable method of combining them, and the results that we may reasonably expect to accomplish. In short, we want to be able to determine whether a given war problem is susceptible of solution by any means at our disposal; or, given the problem, to determine what are the means necessary to accomplish the desired end, and in what manner they must be used.

The study of such problems belongs to the naval administration, the Secretary of the Navy, assisted by his staff of thoroughly trained naval experts. On his efforts in making timely preparations depends largely the final success in war. A very striking illustration of the evils flowing from a want of such knowledge on the part of the administration, of the incapacity to determine whether or not a given war problem is susceptible of solution, is furnished by the case of the attacks on Charleston, S. C., ordered by the navy department during the Civil War. A competent naval administration would have seen that the problem, viz., the

capture of Charleston by the Monitors alone, was insoluble with the means at hand, and hence would not have demanded the impossible.

In these days of "scientific management" it is assumed, as a matter of course, that hereafter no officer will be assigned to duty as a military and naval adviser to the Secretary of the Navy who has not enjoyed the advantages of special training at the Naval War College for that particular kind of service.

From the foregoing it is clear that naval administration includes two separate and distinct parts, each one indispensable to the other: the military and the civil. The "employment of vessels of war," to quote the language of the Act of 1798, establishing the Department of the Navy, comes under the military head; the "construction, armament and equipment of vessels of war" belong to the civil branch.

"My brief experience in this department," to quote from the Secretary of the Navy's report of Nov. 30, 1885, "has satisfied me that, whatever changes in its organization may be desired, it is of the first necessity to separate, as much as practicable, the work of direction and deliberation from the details of execution; in other words that there should be in the construction of the navy, as in every other kind of business, a proper distribution of labor."

Failure to understand these simple truths in the past is the cause of the miscarriage of the several efforts to organize the navy department on sound military and business principles.

Having explained and illustrated the objects and aims of naval administration, we may now give a summary of the efforts of Congress to devise a suitable form for the government of the navy of the United States.

(1) The Act of Congress of October 13, 1775, established a "Marine Committee" composed of members of Congress.

(2) November, 1776, Congress established a "Continental Navy Board."

(3) The Act of October 28, 1779, established a "Board of Admiralty."

(4) February 7, 1781, General Alexander McDougall was made "Secretary of Marine" to take the place of the Board of Admiralty.

(5) The Act of August, 1781, provided for an "Agent of Marine" to supersede all former committees. This duty subsequently devolved upon the "Superintendent of Finance."

(6) August 7, 1789, the navy was placed under the Secretary of War, where it remained nine years. During this period the famous forty-four-gun frigates, *Constitution* and *United States*, and the six-and-thirties *Constellation* and *Chesapeake*, were designed, built and launched.

(7) The Act of April 30, 1798, established a navy department, but in name only.

(8) Act of February 7, 1815, established Board of Navy Commissioners.

(9) Act of August 31, 1842, abolished the Board of Navy Commissioners, abolished the military and executive branch, for which the Navy Commissioners stood, and established the industrial branch represented by bureaus, practically as they exist to-day.

The Act of April 30, 1798, establishing the Department of the Navy, provided for a "chief officer to be called the Secretary of the Navy," "whose duty it shall be to execute such orders as he shall receive from the President relative to the procurement of naval stores and materials; and the construction, armament, equipment and employment of vessels of war, as well as other matters connected with the naval establishment of the United States." He was to have "a principal clerk, and such other clerks as he shall think necessary. . . ." No one could have thought for a moment that the head of one of the great executive departments of the government, a member of the President's cabinet, could concern himself personally with the "construction, armament and equipment of vessels of war," or their "employment"; and yet from the meagre details of this very rudimentary form of naval government that duty must have devolved upon the Secretary himself or upon his civilian clerks—as no others were provided for.

Arranged in tabular form for convenience of reference, Congress, by the Act of 1798, provided for the naval administration of the United States as follows:

The President (Commander-in-Chief)

The Secretary of the Navy (His Exponent)

Executive and Military Branch: (The "Employment of Vessels of War").	Civil and Industrial Branch: ("Procurement of Naval Stores and Materials, Construction, Armament and Equipment of Vessels of War").
Void: Office not provided for.	Void: No provision for such offices.

The War of 1812 exposed the fatuity of having the navy managed by a civilian unassisted by professional advisers, or even the means of carrying on the duties of his office.

With little experience of our own in such matters we naturally turned to England for enlightenment. The division of our State powers into executive, legislative, and judicial was taken from England: we adopted the English common law, and our "Rules for the Better Government of the Navy," commonly known as the "Articles of War," were taken in the main from those of England, with certain necessary changes of phraseology. It was inevitable, therefore, that we should look to England for a sound system of naval administration. Congress attempted to do this when by the Act of February 7, 1815, the appointment of three Navy Commissioners was authorized.

To obtain a full understanding of the origin and nature of the office of Navy Commissioner we must go back to the early history of the English navy. On his accession to the throne in 1685 James II declared himself, in council, Lord High Admiral and Lord General, titles subsequently confirmed by Parliament. And well might King James assume those offices. He combined in his own person the characters of an accomplished seaman and soldier. He was a man of business and of industrious habits. He did much for the improvement of the English navy. But he was false to his great trust as sovereign of a free people. He was in the pay of Louis XIV, his country's bitter enemy. This was the most critical period in English history. It was essential to the cause of civil and religious liberty that the English fleet should dominate the "narrow seas." It was an imperative necessity, therefore, that the question of the government of the English navy should be treated with the gravest consideration. Hence the Acts of Parliament: the one first quoted, and those to be referred to presently. Those acts have come down to our own times. They are no more antiquated to-day than are the fundamental truths on which is based a popular form of government such as that of the United States. These high offices, were by our federal constitution conferred on the President of the United States, under the simple designation of "Commander-in-Chief of the Army and Navy of the United States."

Soon after the Revolution of 1688 Parliament declared that: "*All the powers vested in the Lord High Admiral of England*

may be exercised by the Commissioners for executing the office of High Admiral of England for the time being, according to their commissions." When, therefore, Congress authorized the "appointment of three officers of the navy who shall constitute a Board of Commissioners for the Navy of the United States," and that "the board so constituted shall be attached to the office of the Secretary of the Navy, and, under his superintendence, shall discharge all the ministerial duties of said office," it is clear that the intention was that the Commissioners, in conjunction with the Secretary, should "execute the office" of the constitutional Commander-in-Chief of the navy.

It will be seen from this that the term "Navy Commissioner" defines with precision the exact nature of the office. It was particularly well chosen by Congress.

The relations between the Supreme Executive Magistrate of England and the English navy in 1688, and those of the Chief Executive Magistrate of the United States and the United States navy to-day, are analogous. We have therefore a precedent of over two hundred years of continuous practice, with few intermissions, as a model for our study.

The conditions on this question to-day remain the same as when the English Parliament in 1688 resolved to constitute a "*Commission of Admiralty of such persons as are of known experience in maritime affairs, that for the future all orders for the management of the fleet do pass through the Admiralty that shall be so constituted.*"

The eighth attempt to place the navy on a sound basis was made in the right direction; but, unfortunately, it did not go far enough. It took one-half, only, of the English plan of organization—the military; but left out the civil offices entirely. It granted the right arm of the military body; but withheld the left arm.

Section 1 of the Act of February 7, 1815, provided that: "The President of the United States be, and he is hereby authorized, by and with the advice and consent of the Senate, to appoint three officers of the navy, whose rank shall not be below a Post Captain" (at that time the highest rank in the navy), who shall constitute a Board of Commissioners for the Navy of the United States, and shall have power to adopt such rules and regulations for the government of their meetings as they may judge expedient; and the board so constituted shall be attached to the office of the Secretary of the Navy, and, *under his superintendence*, shall discharge all the ministerial duties of said office, relative to the procurement of

naval stores and materials, and the 'construction, armament, equipment and employment of vessels of war,' as well as all other matters connected with the naval establishment of the United States."

The language of the two acts, Act of 1798 and of 1815, it will be observed, prescribes the same duties for the Secretary and for his advisers, the Navy Commissioners. And it was proper that the prescribed duties should be the same inasmuch as the three commissioners were made part of the Secretary's office. Together they formed the executive and military branch of the department—the branch responsible for the conduct of war. They were to assist the Secretary by their counsel in the "employment of vessels of war" and to "execute such orders as the Secretary shall receive from the President." But it left out, as already observed, the civil branch consisting of offices for the "procurement of naval stores, and the construction, armament and equipment of vessels of war," duties which should have been provided for. The Act of 1815 may be tabulated as follows:

The President (Commander-in-Chief)

The Secretary of the Navy

"Executive and Military Branch: ("For the Employment of Vessels of War").	Civil and Industrial Branch: ("Procurement of Naval Stores and Materials, Construction, Armament and Equipment of Vessels of War").
Three Navy Commissioners.	Void: Offices not provided for.

It is obvious from the very wording of the Act that the principles on which naval administration are based had not been fully considered, for while it provided for the military branch it failed to provide for the civil and industrial branch. The "procurement of naval stores and materials" should not have been assigned, as already observed, as part of the duties of the Secretary of the Navy and his Board of Navy Commissioners, still less the "construction, armament and equipment of vessels of war." These latter duties belong to the civil and industrial branch, and it was a fatal mistake to mix up and confound them with the military branch.*

*Much of the business of the navy department of that day was transacted by naval store keepers, navy agents, and naval constructors. Among the latter were the noted marine architects, Joshua Humphries, Josiah Fox

The system broke down, as might have been expected. The remedy for the defects was sought in the Act of August 31, 1842.

If the secretariat—the Secretary and the three Navy Commissioners—had been left intact, and the civil branch for the "procurement of naval stores," etc., had been added, we should have had a form of naval administration based on sound military and economic principles. From one extreme we now went to the other, and applied a remedy that was worse than the disease.

The navy department is the head of a military organization. The sole object of its being is the conduct of war, or the prevention of war as far as practicable through timely preparation for it. To deprive the head of a military organization of its military functions by leaving the military office vacant was to emasculate the entire system and defeat the very object contemplated by Congress in the establishment of the navy department. Nor was this the worst of it. The mistake in abolishing outright the military branch was aggravated by investing the civil branch with executive authority. When the Navy Commissioners changed from the secretariat—the military and executive branch—to the civil branch as chiefs of bureaus, they would naturally leave behind them their military and executive functions to assume their civil and industrial duties. But the Act of August 31, 1842, authorized the carrying with them to their civil offices their former executive powers, thus invading the prerogatives of the Commander-in-Chief. The net results have been prodigality of expenditures, wastefulness and efficiency. It insured the decadence of the navy.

Our earlier failures to organize a Department of the Navy proceeded from sheer indifference. Up to the time of the War of 1812 the navy was so unpopular that it seemed doubtful at one time if we should have any navy at all.

The Act of 1815 authorizing the appointment of three Navy Commissioners was a wise measure, as we have shown; but it was misunderstood from the first, and by no less a person than the Secretary of the Navy himself, whose hands it was intended to strengthen.

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and Henry Eckford. The first named was the designer of the *Constitution* class of forty-four-gun frigates. But none of these officials formed part of the organization of the navy department.

B. W. Crowninshield, Secretary of the Navy from 1814 to 1818, decided that all military functions belong to the Secretary exclusively, and that the duties of the Navy Commissioners were of a civil character and had to do with matériel only, or such as were subsequently assigned to the several bureaus. This false conception of the character of the navy board gave rise to much friction. It seriously impaired its usefulness, brought it into popular disfavor, and led to the repeal of the Act.

We are indebted for much valuable information on this point to Mr. Charles Oscar Paullin, who has given us a full and interesting account of the Board of Navy Commissioners. He sums up with the remark that: "Unfortunately many of the problems that the board, by reason of its professional information, was best able to solve, did not fall to it, but to the Secretary of the Navy."[5]

This is a very just conclusion on the part of Mr. Paullin and accounts for the failure of the measure. It was not understood.

The arguments in favor of an Act of Congress giving to the Secretary of the Navy responsible military advisers, such as furnished by the Board of Navy Commissioners, were forcibly presented to the Naval Committee of the House, April 11, 1904, by the Secretary of the Navy of that day, the Hon. Wm. H. Moody. They may be reproduced here as more exigent to-day than when delivered in person to the committee.

SOME BODY TO GIVE RESPONSIBLE MILITARY ADVICE.

[Said Secretary Moody:] Gentlemen: In my last annual report I invited attention to the importance to our naval organization of the existence of some body—call it what you please—charged with the duty of giving responsible advice upon military affairs. I said then: "The organization which lacks this feature is defective in a vital part."

As you will recall, I declined to make a specific recommendation at that time and contented myself with urging the earnest attention of Congress to the subject. I believe it to be my duty now to take another step and to make a specific recommendation.

I desire to say that the recommendation which I am about to make is not one which will supplant the present organization of the navy department. It is rather one which supplements that organization. I do not think we can afford to remain content with the existing conditions if we can see any way in which they can be improved. The navy has grown and is

[5] See "Naval Administration under the Navy Commissioners, 1815-1842," by Charles Oscar Paullin. U. S. Naval Institute, Vol. XXXIII, No. 2, June, 1907.

growing rapidly. Naval expenditures have grown so that they are, roughly speaking, $100,000,000 a year, and they are not likely to diminish in the future. With our widely scattered possessions, and a coast line that exceeds that of any other nation except one, and with an intense desire for peace, our people have become convinced of the desirability, of the necessity, of an adequate and efficient navy.

EFFICIENCY THROUGH HONEST, ECONOMICAL ADMINISTRATION.

A large navy—large in ships and personnel—even with the addition of brave and skillful and devoted officers and men, does not necessarily mean an efficient navy. Efficiency comes only through such administration as expends honestly and economically the abundant appropriations given by Congress, and so employs the officers and men and ships as to develop their full capacity for effective use.

HEAD OF NAVY ALWAYS WILL BE CIVILIAN.

Clearing the way a little, I think we can say with certainty that, in conformity with the fundamental ideas which our people hold in common with at least one other nation, the official head of the navy under the direction of the President, who is the Commander-in-Chief, is and always will be a civilian. He is responsible not only to the President, but to Congress and to the country for the administration of the naval establishment. If there comes to be inefficiency and dishonesty and waste, and if there comes to be any great blunder, he alone is going to be held responsible. It will not be of any use for him to say, "I did the best I could." The country is not going to hold some unknown naval officer responsible. It is going to hold the civilian head of the navy to a just accountability for its present efficiency.

I think, therefore, it is just to him as well as essential to the national interests that there should be placed at his disposal such instrumentalities as will best enable him to perform the high functions which are committed to him by law.

SECRETARY CANNOT MAKE WAR PLANS.

Of course he must always be lacking in technical military knowledge. It would be unfortunate if he ever entertained the idea that he was a military man and that he could judge of military questions as well as a man who had made a lifelong study of such questions. He cannot make plans for war or for important operations in peace. He cannot know best how to provide for the needs of the fleet, or by what methods the men may be best trained, or how the capacities of officers may be best developed and utilized. As to all these subjects and those cognate to them he must rely upon the best military advice. It is not enough that there should be plenty of officers ready to give him advice when he seeks it. There should be those charged expressly with the duty of studying military questions and of giving advice for which they can be held responsible.

If I have a question of ship construction to pass upon, and I have many; if I have a question relating to armor or armament, and I have

many, the present organization of the department provides me with a responsible officer, upon whose advice I have the right to rely. I have the right to rely, in questions of shipbuilding, upon the chief constructor of the navy. If I took his advice upon a technical question of construction, I should make him responsible to the country. If there is a question of armor or armament, I have provided for me, by the present organization, the Chief of the Bureau of Ordnance. I am entitled to rely upon his advice.

RESPONSIBLE ADVICE.

Contrast the difference between taking the advice of a responsible officer and taking the advice of one who is irresponsible. Suppose a great mistake occurred in ordnance. It would not be an excuse to me that I had been advised by Admiral Taylor or Admiral Barker or Admiral Higginson, or any other officer whom I might name, because they are not charged with the duty of considering and giving advice on ordnance; but if I said "I have had the advice of Admiral Converse," who is placed at the head of the ordnance of the navy, then I could safely say I have met my responsibility.

Now, a body such as I have referred to has been quite often called a general staff, but I think the names are not important. The realities are the important things.

SOME BODY OF MEN SHOULD BE RECOGNIZED BY LAW.

By whatever name you choose to call it, or however you may choose to constitute it, it is my deliberate opinion that some body of men, charged with the duty I have attempted to describe, should be recognized by law.

It may be said that the Secretary already has the chiefs of bureaus as advisers. At the heads of those bureaus which you have now established by law there are and will be competent officers with adequate technical and military information. They are abundantly able to give safe counsel on the important duties with which their respective bureaus are charged; but they are engrossed with the duties of the administration of their bureaus. They have no responsibility for the consideration of these military questions to which I have referred, nor any duty to give advice upon them; and the world's experience has shown that no advice is good except that for which advisers are held responsible. The volunteer adviser is not usually of much assistance. Much as I have profited by the advice of the bureau chiefs, I know by practical experience that it is impossible for them to take from their administrative duties the time which will enable them to consider these questions with such deliberation as would render them willing to accept responsibility for advice.

NO BODY SHOULD BE CREATED WHICH WOULD USURP SECRETARY'S POWER.

There is another side to the question. On the other side I deem it of the greatest importance that no body should be created which would usurp the powers of the Secretary and make him its mere mouthpiece, or reduce him to a mere figurehead in naval organization. I believe that is not only of importance to the country, but of equal importance to the

navy itself. It is the Secretary alone who can bring effective influence to bear upon the national administration, or, in conference with the representatives of the legislative part of our government, carry such weight that proper measures will be enacted by Congress and proper supplies afforded. Of course, it is ultimately upon the action of Congress that all naval efficiency must depend. I do not care how efficient a general staff may be, or any body called by another name, however well that body may understand the needs of the navy: they can never, in my opinion, except in times of great emergency, wield that influence which brings into harmonious cooperation the national administration, the military power, and the authority of Congress which governs us all.

In proposing this legislation to you, therefore, I have had in mind the importance on the one hand of affording to the Secretary such skill and intelligence as will render him indispensable aid, and on the other hand the importance of preserving the civilian authority, so that there may be harmony between the legislative, executive, and military functions.

These views of Secretary Moody were fully indorsed by former Secretaries of the Navy, Hon. Wm. E. Chandler, sometime member of the Senate Naval Affairs Committee, and General B. F. Tracy.

The Act of 1842 is still in force. It may be tabulated as follows:

The President (Commander-in-Chief)

The Secretary of the Navy

Executive and Military Branch: (The "Employment of Vessels of War").	Civil and Industrial Branch: (The "Procurement of Naval Stores and Materials, Construction, Armament and Equipment of Vessels of War").
Vacated. No provision made for an office of naval operations.	Duties distributed among five bureaus —subsequently increased to eight. Clothed with executive authority.

This Act supplied the left arm of the militant body; *but cut off the right arm.*

It will be seen from what has preceded that during the past 132 years Congress has made nine ineffectual attempts to create a form of naval administration worthy of the name. This is all the more remarkable when it is considered that nineteen years before the passage of the Act of 1798, establishing a Department of the Navy (consisting of one civilian and some clerks), Congress, as already stated, created a Board of Admiralty, to wit: In Congress, October 28, 1779; "Resolved, That a Board of Admiralty be established to superintend the naval and marine affairs of

these United States, to consist of three commissioners, not members of Congress, and two members of Congress," etc.

The disposal of the question of naval administration is of such vital importance as to claim precedence over all others connected with the naval establishment. The principal points to be considered are few and obvious.

First, the Secretary of the Navy must be chosen from civil life; that goes without saying.

Secondly, there must be a board of naval officers authorized by law to act as advisers of the Secretary of the Navy on all questions relating to the "employment of vessels of war" (to quote the Act of 1798), "as well as all other matters connected with the naval establishment of the United States." This provides for the executive and military branch of the Department of the Navy; it is the first and most important step towards bringing the old navy department up to the requirements of the so-called "new navy."

The duties of the civil branch should be distributed, at the discretion of the Secretary of the Navy (as now provided for by the Act of August 31, 1842), among such bureaus as may be retained, but with the pernicious clause of that Act repealed. That clause runs as follows: The "orders of a chief of bureau shall be considered as emanating from the Secretary of the Navy, and shall have full force and effect as such." This clause authorizes an infringement upon the prerogatives of the Secretary—a fatal defect in the law.

Attention has been repeatedly called to the fact that this provision of the Act has the effect, in practice, of creating nine Secretaries of the Navy, each one, in his own particular sphere, clothed with executive authority equal to that of the constitutional Commander-in-Chief. This it is that has created the dire confusion, duplication of work, extravagance and irresponsibility which, according to several Secretaries of the Navy in the past, have characterized the business methods of the navy department for the last sixty years. And this clause, moreover, exposes the fallacy of the contention that, under existing law, the Secretary of the Navy has ample authority, by a redistribution of the business of the bureaus, to correct the many and serious evils of the system now complained of. The source of the trouble is in the law itself.

Any proposition for the organization of the navy department that seeks to impair or restrict in any degree the powers and responsibilities of the Secretary of the Navy, or share with others those powers and responsibilities, as at present, is unworthy of a moment's consideration.

These essential points conceded, all the various details must be worked out by a board of experts convened for the purpose.

It will be seen from the foregoing that there have been adopted, at different periods, two half-measures, each looking to the reorganization of the Department of the Navy, each half excellent in itself, but lacking in balance. It is only necessary to unite these two halves in an amended form in order to obtain a well balanced measure complete in itself.

Thus the Act of February 7, 1815, furnished the military and executive half; the Act of August 31, 1842, supplied the other half—the civil branch. Now let the former be re-enacted in substance but in better shape, and combine it with the Act of 1842, also amended so as to conform to the change, and the result would be a scheme of naval administration based on sound military and business principles. We should then have both right arm and left arm. In other words we should have an office for deliberation and direction, and offices charged with the details of execution. To wit:

The President (Commander-in-Chief)

The Secretary of the Navy

The Assistant-Secretary of the Navy

Military and Executive Branch:	Civil and Industrial Branch:
Navy Commissioners.	Act of August 31, 1842.
The chairman of the board to be "the one responsible adviser of the Secretary." (See General Principles.)	Bureau of Yards and Docks.
	" " Navigation.
	" " Ordnance.
	" " Construction and Repairs.
	" " Steam Engineering.
	" " Supplies and Accounts.
	" " Medicine and Surgery.
	Without executive authority.

GENERAL PRINCIPLES GOVERNING NAVAL ORGANIZATION.

The Commission on "Certain Needs of the Navy," appointed January 27, 1909, by President Roosevelt, and of which Justice Wm. H. Moody was presiding officer, reported on "General Principles Governing Naval Organization," as follows:

1. The office of the Secretary of the Navy being executive in character, nothing should be admitted into an organization of the department which would qualify his authority or diminish his ultimate responsibility. He has been in the past, and in the future should be, a civilian. He is the representative of the President, the constitutional Commander-in-Chief of the army and navy, under whose direction his authority is exercised.

2. The duties in charge of the Secretary divide under the principal heads, closely related but generically distinct: civil and military.

The civil duties embrace the provision or preparation of all the material of war. This is the function of the present bureaus.

The military duties concern the use of that material, whether in war or in such exercises as conduce to fitness for operations of war. For the direction of these military duties, no subordinate provision corresponding to the bureaus on the civil side exists in the present organization established by statute.

3. The discharge of both these classes of duty involves a multitude of activities, quite beyond the immediate personal knowledge and supervision of a single man. This necessitates a subdivision of the duties, by which means the supervision of the Secretary is exerted through the medium of responsible subordinates. In this subdivision the principle of undivided responsibility, within the appointed field of subordinate supervision, should obtain, as it does in the superior office of the Secretary.

The bureau system, as now established by law for the civil activities of the department, insures for each bureau this undivided responsibility, qualified only by the authority of the Secretary, which, if exerted, does not divide the responsibility, but transfers it to the Secretary himself. Independent authority, with undivided responsibility, though in principle proper, suffers historically from intrinsic inability to cooperate, where a number of such independent units are present. The marshals of the first Napoleon —especially in Spain—in the absence of the Emperor, offer a familiar illustration. The bureau system as at present constituted by law contains no remedy for this inherent defect.

4. The coordinating power is in the Secretary's authority; but, owing to the shortness of tenure in office, and to the inevitable unfamiliarity with naval conditions with which an incumbent begins, authority, though adequate in principle, is not so in effect. This inadequacy consists in lack of personal familiarity with the subjects before him, not merely severally, but in their collective relations; in short, lack of specific knowledge and experience. The organization should provide him with such knowledge and experience, digested formally, so as to facilitate his personal acquirement. In short, an advisory body, equipped not with advice merely, but with reasons. In order to avoid the interruption of continuity attending each new administration, entailing the recurrent temporary unfamiliarity of each new Secretary, it is expedient that this advisory body be composed of several persons, but while this provision would insure the continuity which inheres in a corporate body (in this case continuity of knowledge and of progress), the principle of undivided responsibility would dictate that one only of them should be responsible for the advice given to the common superior—the Secretary.

5. As regards the composition of the advisory body, the principles to be regarded are two: (a) The end dictates the means; (b) responsibility must be individual, in advice as well as in executive action.

(a) The end is efficiency for war. The agents in war are the military naval officers. Their profession qualifies them best to pronounce upon the character of the preparations for war of every kind, including not only schemes of campaign and tactical systems, but the classes, sizes, qualities, and armaments of ships of war.

What the Secretary needs, specifically and above all, is a clear understanding and firm grasp of leading military considerations. Possessed of these, he may without great difficulty weigh the recommendations of his technical assistants, decide for himself, and depend upon them for technical execution of that which he approves.

However constituted in detail, the advisory body should be taken entirely from the class to which belongs the conduct of war, and upon whom will fall, in war, the responsibility for the use of the instruments and for the results of the measures which they recommend.

(b) As regards individual responsibility for advice, it is suggested that the Secretary of the Navy nominate to the President the officer whom he deems best fitted to command the great fleet in case of war arising; and that this officer, irrespective of his seniority, should be head of the advisory body. He alone should be the responsible adviser of the Secretary.

The provision of a responsible adviser does not compel the Secretary to accept his advice, nor prevent his consulting whomsoever else he will. The provision suggested does not limit the authority of the Secretary; but it does provide him with the weightiest and most instructed counsel, and it lays upon the prospective Commander-in-Chief the solemn charge that in all he recommends he is sowing for a future which he himself may have to reap.

An essential principle in the constitution of such an advisory body is that the majority of the members should be on the active list and should go afloat at not infrequent intervals; and, specifically, the head of the body, the prospective Commander-in-Chief, should during the summer months take command of the concentrated battle-ship force for maneuvers, target firing, and practice of every kind. This will insure also his sustained familiarity with the administrative routine of the fleet and other practical matters.

6. In the two principal classes into which the duties of the Secretary of the Navy divide, civil and military, as enunciated in Section 2 above, the word "civil" corresponds largely to the activities known as technical; and there is no reason apparent why the same principle of undivided immediate responsibility should not be realized in the navy department in two chief subordinates, responsible, the one for military supervision, the other for technical supervision, and for all information and advice given to the Secretary under these two heads. It is of course apparent that a perfectly suitable Secretary may come to his office with as little previous knowledge of the kind called technical as he has of military; nay, he may be perfectly efficient, and yet not acquire in his four years of office either the technical or the military knowledge presumable in men whose lives have

been given to the two professions. Under the most favorable conditions, every superior must take decisions largely on advice; which means not accepting another's opinions blindly, but accepting statements of facts and weighing reasons.

The principle of the Secretary's ultimate individual responsibility dictates that he be at liberty to consult as many advisers as he thinks necessary; but the principle of the individual responsibility of two chief advisers, for the advice given, tends to insure the most exhaustive consideration on the part of men selected for their special competency. Careful consideration with special competency give the best guarantees for advice, and a Secretary overruling it would do so under the weightiest sense of personal responsibility.

As a matter of detail, but yet so broad in bearing as to amount to a principle, it may be noted that while the adjective "military" is somewhat narrow in application, "technical" is extensive in scope. Naval construction, ordnance, and steam engineering are all technical professions. The selection of a chief technical assistant to the Secretary might therefore be made from the recognized technical experts of the navy, under any of the three heads named, or a competent civilian engineer and naval architect may be appointed as Second Assistant Secretary of the Navy, under whom the four technical bureaus may be coordinated.

7. In conclusion, it should be distinctly laid down as a cardinal principle that no scheme of naval organization can possibly be effective which does not recognize that the requirement of war is the true standard of efficiency in an administrative military system; that success in war and victory in battle can be assured only by that constant preparedness and that superior fighting efficiency which logically result from placing the control and responsibility in time of peace upon the same individuals and the same agencies that must control in time of war. There should be no shock or change of method in expanding from a state of peace to a state of war. This is not militarism; it is a simple business principle based upon the fact that success in war is the only return the people and the nation can get from the investment of many millions in the building and maintenance of a great navy.

(See 60th Congress, 2d session. Senate. Document No. 740.)

The proposed acts would, with the exception of a change of name, and a slight amendment of the Act of 1842, give the sanction of law to the organization of the Department of the Navy as it now tentatively exists.

It will be seen from what has preceded that the Act of August 31, 1842, abolishing the Board of Navy Commissioners, is still in force. With the abolishing of the Board of Navy Commissioners was abolished the body "charged with the duty of giving responsible advice upon military affairs." "The organization which lacks this feature," it has been explained, "is defective in a vital part."

With the abolishing of the Board of Navy Commissioners was abolished the military head of our military marine.

With the abolishing of the Board of Navy Commissioners was abolished the office charged with the conduct of war.

It must be plain to the dullest understanding that in this respect our naval organization is no more prepared for war to-day than it was sixty-nine years ago. And this, too, notwithstanding the lessons of two wars and the urgent appeals of successive administrations to Congress to remedy this grave defect—successive administrations representing each one of our great political parties.

In a former article—*North American Review* of April—we said: "In building up a navy the public mind seems to be centered on ships alone. Tables are published from time to time showing the comparative strength of navies as measured by the number of battleships of each country together with their tonnage and gun-power."

This is misleading as far as our own navy is concerned, in that it takes no account of all the various accessories essential to a fleet of the present day, such as naval bases, personnel, etc. In contemplating with pardonable pride our fleet of battleships we have lost sight of the fact that in abolishing the Board of Navy Commissioners in 1842 Congress has never substituted any office to supply its place: We have fashioned the instrument—the fleet; but have failed to provide the power to wield it as a weapon of war.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE AMERICAN NAVY IN THE ORIENT IN RECENT YEARS.

By Charles Oscar Paullin.

I.

The Asiatic Squadrons 1865-1898.[1]

On the termination of the Civil War in 1865, the East India, or Asiatic squadron, as it was now called, was reëstablished. Additional vessels were gradually added to it, until in 1866 it contained nine, and in 1867 thirteen vessels. Soon, however, when the decline of the navy set in, its size was slowly diminished, and in 1889 it contained only three ships—three decaying hulks of the old steam navy. The first ship of the new navy in the Asiatic squadron was the U. S. S. *Charleston,* which arrived at Yokohama in September, 1891. Seven of the eight ships that composed the squadron in 1897 belonged to the new navy. The first flagship after the Civil War was the *Hartford,* made famous by the achievements of Farragut; and the last flagship before the Spanish-American War was the *Olympia,* the principal vessel of Dewey's fleet at the battle of Manila Bay. On the completion of the Suez Canal in 1869, a new route to the Far East was opened to our ships, and in the following year the *Palos* took advantage of it on her outward passage to the station.

The commanders-in-chief of the Asiatic squadron from 1865 to 1898, their principal flagships, and the periods of their service were as follows: Rear-admiral H. H. Bell, *Hartford,* 1865-1868; Commodore J. R. Goldsborough, *Hartford,* 1868; Rear-admiral

[1] The chief sources of information for this chapter are the Asiatic Squadron Letters, 1865-1871; Annual Report of the Secretary of the Navy for 1867, 54-62; for 1871, 275-313; Schley, W. S., Forty-five Years Under the Flag, 73-96; and House Ex. Doc. No. 1, part 1, 41 Cong. 3 sess., pp. 334-339; No. 1, part 1, 42 Cong. 2 sess., 112-153.

Stephen C. Rowan, *Piscataqua* and *Delaware*, 1868-1870; Rear-admiral John Rodgers, *Colorado*, 1870-1872; Rear-admiral Thornton A. Jenkins, *Colorado, Lackawana* and *Hartford*, 1872-1873; Rear-admiral E. G. Parrott, *Hartford*, 1873-1874; Captain E. R. Colhoun, *Hartford*, 1874; Rear-admiral A. M. Pennock, *Hartford* and *Saco*, 1874-1875; Commander R. F. R. Lewis, *Kearsarge* and *Yantic*, 1875; Rear-admiral William Reynolds, *Tennessee*, 1875-1877; Rear-admiral T. H. Patterson, *Tennessee, Monocacy* and *Monongahela*, 1877-1880; Rear-admiral J. M. B. Clitz, *Richmond* and *Monocacy*, 1880-1883; Rear-admiral Pierce Crosby, *Richmond*, 1883; Captain Joseph S. Skerrett, *Richmond*, 1883; Rear-admiral John Lee Davis, *Richmond, Monocacy, Enterprise* and *Trenton*, 1883-1886; Rear-admiral Ralph Chandler, *Marion* and *Brooklyn*, 1886-1889; Rear-admiral George E. Belknap, *Monocacy, Omaha, Marion, Charleston* and *Alliance*, 1889-1892; Rear-admiral D. B. Harmony, *Marion* and *Lancaster*, 1892-1893; Rear-admiral John Irwin, *Lancaster*, 1893; Rear-admiral Joseph S. Skerrett, *Lancaster* and *Baltimore*, 1893-1894; Rear-admiral C. C. Carpenter, *Baltimore*, 1894-1895; Rear-admiral F. V. McNair, *Olympia*, 1895-1898.

All of these officers had served in the navy during the Civil War, and several of them had filled responsible posts. At the capture of New Orleans, Bell commanded a division of Farragut's fleet, and later in the war he commanded the West Gulf blockading squadron. Rowan conducted several important expeditions up the sounds of North Carolina. Early in the war Rodgers was detailed by the navy department to build a fleet of vessels on the Mississippi, and in 1863 he captured the Confederate ironclad *Atlanta* and received a vote of thanks from Congress for his eminent zeal and ability. Jenkins was a fleet captain, and took a prominent part in several important engagements; and Pennock served for a time as commander of the Mississippi squadron.

From the close of the Civil War until the beginning of the Spanish-American War, the work of the Asiatic squadron, with the exception of certain tasks relating to Korea, was largely of a routine character. It consisted chiefly of paying visits to the principal ports of the station, surveying coasts and harbors, and suppressing piracy. Occasionally the officers of the squadron were compelled to land a detachment of men to protect American

interests. Thus in 1866 a hundred seamen and marines, under the command of Lieutenant John W. Philip, was sent ashore at Newchang to capture a party of Chinese, which was implicated in an assault upon the American consul at that place. In 1888, and again in 1895-1896 during the war between China and Japan, a small detachment of seamen and marines was stationed at Seoul, Korea, to protect the Americans residing there.

After the Civil War, the number of American merchantmen in the Far East needing the protection of the navy was relatively smaller than before, for our merchant marine never regained the prestige that it lost during that conflict. The flag of the United States was in large measure supplanted by the flags of Great Britain and Germany. In 1868, however, Rear-admiral Rowan reported that the American trade with Manila was still considerable, amounting to forty ships a year. Soon after the war the headquarters of the squadron in China were established at Hong Kong, and in Japan at Yokohama.

In March, 1867, the natives of Formosa murdered the officers and crew of the American bark *Rover,* which had been wrecked on the coast of that island. Early in June, acting under orders from the navy department, Rear-admiral Bell sailed from Shanghai, with the *Hartford* and *Wyoming,* for the southeast coast of Formosa, for the purpose of destroying the lurking-places of the natives. During the voyage he organized a landing party composed of sailors and marines and armed it with muskets, rifles and howitzers. On reaching his destination some interesting events took place, which he described as follows:

"Next morning, June 13, at half past eight o'clock, we anchored within a half-mile of the shore, on the southeast side of the large open bay indenting the south end of Formosa, a somewhat dangerous exposure at this season of typhoons. though a perfectly safe and convenient anchorage during the northeast monsoon, from October until May. The landing of one hundred and eighty-one officers, sailors, and marines, provided with four days' rations and water, was made at half past nine o'clock, under the command of Commander G. E. Belknap of the *Hartford,* accompanied by Lieutenant Commander Alexander S. Mackenzie, fleet lieutenant, as second in command, who earnestly sought to go on the expedition. Soon after we anchored, the savages, dressed in clouts, and their bodies painted red, were seen,

through our glasses, assembling in parties of ten or twelve on the cleared hills about two miles distant, their muskets glistening in the sun, indicating the kind of arms they carried. Their movements were visible to us on board during the most of the day. As our men marched into the hills, the savages, knowing the paths, boldly decided to meet them, and, gliding through the high grass and from cover to cover, displayed a strategy and courage equal to our North American Indian. Delivering their fire, they retreated without being seen by our men, who, charging upon their coverts, frequently fell into ambuscades. Our detachments pursued them in this harassing manner out of sight of the ships until two o'clock p. m., when, having halted to rest, the savages took the opportunity to creep up and fire upon the party commanded by Lieutenant Commander Mackenzie, and that officer, placing himself at the head of the company commanded by Lieutenant Sands, daringly led a charge into the ambuscade that was laid for them, and fell, mortally wounded by a musket ball, and died whilst being carried to the rear. The navy could boast no braver spirit and no man of higher promise than Lieutenant Commander Alexander S. Mackenzie. He was distinguished for professional knowledge, aptitude, and tact, and suavity of manners, which inspired the confidence and affection of men, while his impetuous courage impelled him always to seek the post of danger, where he was always seen in the advance, both a conspicuous mark and an example. Several officers and men having already experienced severe sunstrokes, and the command being generally exhausted and worn out by their efforts to get at the enemy during four hours' marching, Commander Belknap now thought it expedient to regain his picket on the beach, and, during this march of two or three miles, many of the men got into such a deplorable condition from the killing heat of the sun that the commander determined to return with them on board of ship, which he reached about 4 p. m., after an exhausting march of six hours under the sun at 92°. That afternoon the fleet surgeon reported the casualties of the day—one killed, fourteen sunstruck, four of them dangerously."[2]

Of the officers who took part in the skirmishes with the savages, Commander George E. Belknap, Lieutenant James H.

[2] Asiatic Squadron Letters, 1867-1868, 303-307.

Sands and Midshipman W. M. Folger later became rear-admirals. The chief marine officer, Captain James Forney, was made a major by brevet for his gallant and meritorious services on this occasion. He is now (1909) a brigadier-general, ranking next to the senior officer of his corps. The brave Mackenzie was buried with appropriate honors at Takao, Formosa, in the garden of the British consulate.

The opening of additional Japanese ports to foreigners and the continuation of the conflict between the Tycoon and Mikado gave considerable employment to our ships of war in 1867-1869. In the spring of 1867 all the foreign ministers visited the Tycoon at the inland port Osaka, the American minister, Mr. R. B. Van Valkenburgh, being conveyed thither from Yokohama by the *Shenandoah* and *Wyoming*. Toward the latter part of that year Bell assembled six vessels of his squadron at Osaka and the neighboring port Hiogo to participate in the events attending the opening of those ports to foreign commerce on January 1, 1868. After the conclusion of the ceremonies, Bell delayed his departure, since it was apparent that hostilities between the contending factions were likely to break out at any time. On the morning of January 11 a most lamentable accident occurred at Osaka. The admiral, Lieutenant Commander J. H. Reed, and thirteen men belonging to the *Hartford* started for the shore in a barge to visit the American minister. Before reaching their destination, the barge was capsized by a heavy sea, and all on board, with the exception of three seamen, were drowned, nothwithstanding every effort was made to save them by the boats of the squadron. On the death of Bell, Commodore J. R. Goldsborough became commander-in-chief.

The expected contest at Osaka between the opposing forces began on January 27 and lasted several days, ending in a decisive defeat of the Tycoon. On the night of the 31st that unfortunate ruler, accompanied by about a dozen of his principal retainers, sought refuge on board the American naval ship *Iroquois,* Commander Earl English, who received the refugees, and the next morning sent them to one of the ships of the Tycoon. On the following night the American, Prussian, Italian and Dutch ministers were compelled to flee from their legations to the *Iroquois* for safety. They too were received by English and were later conveyed to Hiogo, whither also came the French and

British ministers. Here, the legations were reëstablished, under the protection of guards landed from the foreign fleets in the harbor. The American fleet was commanded by Commander G. B. Creighton.

On February 4 a detachment of Japanese troops assaulted the foreign residents at Hiogo, wounding several of them, among others an apprentice of the U. S. S. *Oneida*. This act of violence was resented by a party consisting of the marine guard at the American legation, the body-guard of the British minister, and several boats' crews from the foreign fleets, which went in pursuit of the Japanese troops and drove them into the mountains near the city. Soon after this incident, in response to a request for protection jointly signed by all the foreign ministers, the commanders of the several foreign fleets took measures of defense by seizing four Japanese steamers, by landing a considerable party of sailors and marines, and by fortifying the foreign settlement. On the 8th an envoy of the Mikado arrived at the American legation with the information that the Tycoon had been outlawed and that the Mikado was supreme in the government of Japan. On his giving assurance that the foreigners would be protected, the detachments of sailors and marines were withdrawn, and the Mikado's forces took possession of the city. The Japanese officer who on February 4 had commanded his troops to fire on the foreigners was subsequently executed, in the presence of several officers of the foreign fleets and legations. At the request of Van Valkenburgh, Commander Creighton witnessed the execution, a grewsome sight, which he thus describes:

> In a few moments the prisoner came in, dressed in the usual Japanese dress of a person of rank, accompanied by the executioner, who was his pupil and most intimate friend. He walked with a steady firm step in front of the altar, where he knelt in prayer. He then arose and went to the red cloth where he knelt and made the confession that he was the officer that ordered his troops to fire upon the foreigners, and also to fire upon them when they were trying to escape and that he was sorry for what he had done. He then disrobed himself to his waist, and reached out for a knife that was near him, which he thrust into his bowels and drawing it towards his right side, and leaning forward at the same time, the executioner with one blow from his sword severed his head from his body.[3]

In March the ministers returned to Yokohama, those for the United States, Italy and Prussia, taking passage on board the

[3] Asiatic Squadron Letters, 1867-1868, 76.

U. S. S. *Monocacy,* Commander S. P. Carter. Here some American and German marines and French and British troops were landed for the protection of the foreign settlement. Early in January, 1869, the ministers went to Tokio (formerly Yedo), to pay their respects to the Mikado, who, having triumphed completely over the Tycoon, had taken possession of his capital. Commander Carter conveyed Van Valkenburgh to Tokio, and witnessed his interview with the Mikado, the first between that ruler and a representative of America. This initial meeting is thus described by Carter:

Soon after we were shown into the waiting-room, the first Councilor of the Empire entered and was presented to the ministers, who were told the Mikado would in a short time be ready to receive them. Not long afterwards the court band commenced to play in a singularly weird and doleful strain, more like a funeral dirge or *miserere* than any thing else, and so different from Western music as to make it impossible for one to describe. I understood from some of the Japanese officers that the Mikado was then entering the audience-chamber. In a short time it was announced to the U. S. minister that the Mikado was ready to receive him.

A short distance down the veranda and a turn to the right brought us to the entrance of the audience-room and in presence of the Mikado. There was a bow after crossing the threshold, another when half way to the dais, and a third on reaching it. While the minister advanced on the platform to within a few paces of the Mikado, who sat on his throne (an arm-chair apparently), under a canopy of white silk, with his Councilor kneeling on his right; the suite stopped at the edge of it. On the minister beginning his speech, the Mikado rose to his feet. On each side of the room were guards standing motionless, some dressed in red, and others black silk.

While the light in the room was not very good, the day being overcast and gloomy, I could not see anything in the face of the Mikado, indicative of either much energy, mind, or character; still for one so young (he is said to be but seventeen), he conducted himself with becoming dignity. He was dressed in a robe of white silk and petticoat trousers of crimson, and had on his head a curious headdress of fine wire similar to those worn by several of his chief officers. After the minister had read his speech, he presented each of us by name. The audience was quite short, but everything passed off well and satisfactorily.

The Prussian chargé d' affaires had his audience immediately after the U. S. minister, and the British minister soon after the latter. So far as I have heard the forms in the presentations were exactly similar in each case.

From the castle we drove to the temporary Foreign Office, where later in the afternoon the Minister of Foreign Affairs gave first a Japanese and afterwards a European dinner to the three ministers and their suites, who had been that day presented to the Mikado. At the latter dinner the Min-

ister of Foreign Affairs proposed the health of the President of the United States, the Queen of Great Britain and the King of Prussia, which was properly honored. The health of the Mikado was afterwards proposed and drunk. The day ended pleasantly.

I have been thus minute for the reason that this is the first, and to this date, only audience that Americans have ever had with the Mikado of Japan." [4]

The Japanese civil war, which was succeeded by a long period of peace, was now at an end. Already political conditions in the Far East had so shaped themselves that it was possible to forecast some of Japan's future difficulties. Writing in 1869, Rear-admiral Rowan, after enumerating the encroachments of Russia in the islands of Saghalien and Yesso, expressed the opinion that "in twenty years Japan will be Russia unless foreign nations prevent."

While Rowan was in command of the fleet, the U. S. S. *Oneida* was lost in the Gulf of Yedo by a collision with the British mail steamer *Bombay*. The accident occurred at seven o'clock in the evening of January 24, 1870. The commander of the *Oneida,* Commander E. P. Williams, nineteen officers, and ninety-five seamen were drowned. Four officers and fifty-seven seamen were saved in the ships' boats. Unaware of the seriousness of the injuries she had inflicted, the *Bombay* continued on her course into port, notwithstanding that the sinking vessel made numerous signals of distress.

The most important work of the navy in the Far East during the third of a century that elapsed between our Civil War and the Spanish-American War was concerned with the opening of Korea, the Hermit Nation. That country is a peninsula, with an area of about ninety thousand square miles and a population of possibly ten million people. Like China and Japan it long pursued toward foreign nations a policy of isolation and exclusiveness. It was unable, however, to avoid having some connection with its two powerful neighbors, Japan and China. For many years Japan claimed a suzerainty over Korea, which in early times was acknowledged by the vassal state. Later Korea acknowledged the suzerainty of China and sent annually to Peking an embassy bearing tribute. Both China and Japan carried on a small trade with the Koreans.

[4] Asiatic Squadron Letters, 1869, 35-38.

Toward the close of the eighteenth century the French Catholic missionaries obtained a footing in the peninsula, and for many years successfully prosecuted their work, notwithstanding the opposition of the Korean government. In 1832 the British East India Company sent a religious and commercial expedition to Korea, which, however, failed of important results. In 1866 the Koreans began a new persecution of the foreign missionaries, all of whom were in a few months either driven out of the country or killed. As many of the missionaries were Frenchmen, the French government sent an expedition to demand satisfaction for the injuries inflicted on its citizens. After capturing and burning the town of Kang-hoa, the French forces were so harassed by the natives that they were compelled to withdraw and to return to China.

In 1845 a resolution was introduced in the United States House of Representatives recommending that measures be immediately taken to effect a commercial arrangement with Korea; but nothing came of this initiative. Not until about the time of the French expedition was the United States brought into relation with the Koreans. In June, 1866, the American merchantman *Surprise* was wrecked on the west coast of the peninsula; and the castaways were supplied by the local authorities with necessary comforts, were transported on horseback to the northern frontier and were there delivered to some Chinese officials.

Three months later a quite different fate befell the officers and crew of the American schooner *General Sherman*. The particulars of the visit of this vessel to Korea have never been fully ascertained. It appears that she was chartered by an English house at Tientsin, was laden with merchandise and was sent to the west coast of the peninsula to trade. Her owner (who sailed with the ship), master and mate were Americans; her supercargo and interpreter were British; her crew were Malays and Chinese, and there were two Portuguese on board. She sailed from Chifu on August 8, 1866. In November Rear-admiral Bell received word that she had been wrecked on the Korean coast, and that subsequently she had been burned, with all her people, by order of the king regent of Korea. He at once decided to send one of his ships to investigate her loss, and he wrote to the Secretary of the Navy recommending that the squadron be reënforced with some fifteen hundred or two thousand troops, with a view to

obtaining possession of Seoul, the capital, and to demanding satisfaction of the king regent. This advice the American government did not see its way clear to follow.

The vessel chosen by Bell to investigate the loss was the U. S. S. *Wachusett,* Commander Robert W. Shufeldt, an officer equally distinguished for his naval and diplomatic achievements. Leaving Chi-fu on January 21, 1867, Shufeldt two days later came to anchor off the Korean coast opposite the Sir James Hall group of islands, near the mouth of a large inlet. Had the voyage been feasible in the winter season, he would have proceeded to the Ta-tong (also called the Ping-yang) River, fifty miles northward, up which stream the *General Sherman* was lost. Shufeldt entered into communication with the natives at the villages near his anchorage and, after meeting with some difficulties, induced one of the chiefs to despatch into the interior a letter addressed to the king of Korea. Several days after the departure of a messenger with this letter, an official of Hae-chow-poo, the capital of the province in whose waters the *Wachusett* had anchored, came on board the ship. He said that he knew nothing of the *General Sherman,* and he ordered Shufeldt to depart speedily and return to his own country. The natives near the anchorage were more communicative respecting the lost vessel, and they all told the same story, namely, that she was burned in the Ping-yang River and that all her people were killed in a melée on shore. Unable to secure any additional information and inclined to believe that he had the truth of the matter, Shufeldt returned to China, without having received an answer to his letter to the king. One may add that the inlet visited by the *Wachusett* was wrongly supposed to be the Ta-tong River, as may be seen from a chart prepared by her officers. The true Ta-tong River they called the Ping-yang River.

Some months after the return of Shufeldt, it was reported that four seamen of the crew of the *General Sherman* were still alive and were detained as prisoners in the city of Ping-yang. To test the accuracy of this report, Commodore Goldsborough ordered the U. S. S. *Shenandoah,* Commander John C. Febiger, to proceed up the Ta-tong River and to investigate further the loss of the unfortunate schooner. In the spring of 1868 Febiger spent several days surveying the river and communicating with the local authorities. When about twenty-five miles up the stream,

he was fired upon by a military post but was not hit. He obtained considerable information respecting the lost vessel, little of which, however, could be depended upon. Among the communications that he received was one from the *ex-officio* inspector of the Imperial Board of Directors of Korea, addressed to Commander Shufeldt and replying to that officer's letter to the king. This gave a version of the loss of the *General Sherman* favorable to the Koreans, and represented her captain as the aggressor. The principal result of the visit of the *Shenandoah* was a survey of the Ta-tong River and its approaches.[5]

The affair of the *General Sherman* naturally led our government to consider the possibility of making a treaty with Korea. Both Rear-admiral Stephen C. Rowan, commander-in-chief of the Asiatic squadron, and his successor, Rear-admiral John Rodgers, proposed the sending of a naval expedition to Korea, similar to that of Commodore Perry to Japan. The government finally decided to make an attempt to negotiate a treaty, to intrust the negotiations to Mr. F. F. Low, the American minister to China, and to provide him with an imposing naval escort. Rear-admiral Rodgers would have been chosen to undertake the mission instead of Low, had it not been desirable to enlist the good will of China and, if possible, her good offices, by selecting the American diplomatic representative at Peking. Low was directed to consult with Rodgers throughout every stage of the negotiations, and Rodgers was ordered to convey Low to Korea on board his flagship, accompanied with as many vessels of his squadron as could be spared. In November, 1870, the two officers conferred together at Peking and settled the details of the expedition. Doubtless having in mind Perry's procedure in Japan, they agreed to leave Korea after they had informed the authorities of the purpose of their visit and to return a month later for the reply of the government. "This," said Rodgers, "would prevent difficulties from arising between our peoples, avoid any appearance of coercion and leave their imaginations to augment the dangers of refusal." Before leaving Peking, Low sent through the Chinese government to the king of Korea a message explaining

[5] Asiatic Squadron Letters, January, 1867-April, 1868, 693-702; October, 1867-December, 1868, 164-196; one version of the loss of the *General Sherman* will be found in the Korean Repository (Seoul) for 1895, pp. 251-254.

the purpose of the expedition and giving assurances of its friendly character.

Having collected all accessible information relating to the navigation of Korean waters, Rodgers in May, 1871, assembled at Nagasaki a fleet of five steamships, carrying eighty-five guns and twelve hundred and thirty men. On board the flagship *Colorado* were the rear-admiral and Minister Low with his suite consisting of secretaries, interpreters, Chinese writers and servants, and five shipwrecked Koreans who were being returned to their native land. Besides the *Colorado*, Captain G. H. Cooper, the fleet comprised the *Alaska*, Commander H. C. Blake, *Benicia*, Commander L. A. Kimberly, *Monocacy*, Commander E. P. McCrea, and *Palos*, Lieutenant C. H. Rockwell. By the middle of May the fleet was ready to sail. "On the morning of May 16th," wrote an observer on board the flagship, "the signal to weigh anchor was hoisted, and our saucy little squadron moved gracefully through the magnificent outlet of Nagasaki harbor. The weather was calm and delightful, and all hands were highly elated with the prospect of penetrating the mysterious land that had formed the theme of our dreams, arguments, and surmises for many months."[6]

There was much doubt in Low's mind whether the mission would prove successful. Rodgers took a brighter view of its prospects, writing thus on the eve of its departure from Nagasaki: "The anticipations vary very much as to the reception we shall probably meet. I will hope, until facts dispel hope, that we shall meet with success. The time has come, I infer from what I learn, for the Koreans to make a treaty; and if we do not succeed now, some other power or powers will probably be more fortunate."[7]

On the 19th the fleet arrived at the Ferrieres Islands on the west coast of Korea, and on the 30th, after a course had been sounded and surveyed, came to anchor near the mouth of the Salée or Han River, some thirty miles from Seoul. Low and Rodgers decided to remain here until they communicated with the king, and in the meantime to survey the river. Soon after the *Colorado* anchored, she was visited by four Koreans who

[6] Willis, G. R., The Story of Our Cruise in the U. S. Frigate *Colorado*, 62.
[7] Asiatic Squadron Letters, 1870-1871, 309.

said that three officials of their government were waiting on shore to ascertain the object of the expedition. On the next day the officials came on board the flagship, and as they were of inferior rank, Low directed his two secretaries to receive them. They were informed that the American minister had important business to transact with their government, which would be made known to a person of equal rank duly appointed by the king, and that it was the desire of America to establish peaceful relations with Korea. They were also told, as had been the visitors of the previous day, that it was the intention of the surveying vessels to proceed up the river and that every effort would be made to avoid trouble. They made no objection, but, on the contrary, gave "tacit assurances" that the expedition would meet with nothing but civility and kindness from the natives.

On June 1 the *Monocacy*, *Palos*, and four steam launches, under the command of Commander H. C. Blake, went up the river on surveying duty. When about five miles from the fleet, the little flotilla came to a sharp turn in the channel where the navigation was very difficult. The current, which set in from the sea, was swift and full of eddies, and flowed over dangerous ledges. On the left-hand side, on a hill overlooking the river, were some Korean fortifications, known as Fort du Coude, which were manned by a thousand men. In the main fort there were two or three large guns, perhaps as large as 32-pounders, and many smaller guns. From a parapet a flag was flying, the Chinese inscription on which signified "commanding general."

The launches of the flotilla were in the lead, and as they came abreast of the fort they were suddenly surprised by a heavy discharge of artillery from some batteries on the hill-side, which had been concealed from their view by mats and screens. They at once returned the fire as fast as the whirls and eddies of the river permitted. The *Monocacy* and *Palos* soon came up, and, though greatly hampered by the perilous navigation, they trained their guns so effectively that within a quarter of an hour the Koreans fled precipitately to the ravines and brush covers in the rear of their works, carrying with them their flags and standards. The current rapidly swept the flotilla past the turn of the river to a position above the forts, where it came to anchor and continued to fire upon them as long as any indications of their being occupied were discoverable. None of the vessels of the flotilla

was injured by the enemy's fire. The *Monocacy,* however, ran upon the rocks, and the *Palos* had to cut away her rail and bulwark on the port side to permit the use of her guns. The loss of the Americans was two wounded, and of the Koreans thirty killed and many more than that number wounded. One of the launches did not take part in the engagement. Being disabled early in the voyage, she followed the other vessels up the river at some distance and was fired upon by several forts below Fort du Coude, which did not molest the other vessels of the flotilla.

After a careful consideration of this incident, Low and Rodgers decided that the prestige of the United States would be impaired if the injury to its flag was not avenged or was not apologized for by the Korean government. Through one of his secretaries Low explained to an officer of the local prefecture that sufficient time would be allowed for an apology before any further steps were taken. While deeply regretting the firing on the flotilla, the officer defended the action of the forts, on the ground that the Korean laws prohibited foreigners to pass a barrier of defense. He sent a present of chickens, bullocks, and eggs to Rodgers, who declined to accept it.

In the meantime Low received a letter from the king, which, while somewhat evasive, plainly indicated that he did not wish to make a treaty with the United States. He denied that his subjects were the aggressors in the *General Sherman* affair, and referred to three instances in which he had protected shipwrecked Americans. Low did not reply to this letter as other matters now engaged his attention. No apology had been made by the Korean government, and a retaliatory expedition was being prepared for offensive operations.

Nine days elapsed between the firing on the flotilla and the sailing of the retaliatory expedition, an interval during which Rodgers was busily engaged with preparations for the intended movement. He organized and drilled a division of sailors and marines, made ready supplies and ordnance, and settled all questions of transportation. He chose Commander H. C. Blake to command the expedition. The command of the land forces fell to Commander L. A. Kimberley. Lieutenant Commander W. S. Schley was made adjutant of the land forces, which consisted of six hundred and fifty sailors and marines, a corps of sappers and miners, and an ambulance corps. The marines, one hundred and

five in number, were under Captain McLane Tilton of the marine corps. The co-operating force consisted of the *Monocacy* and *Palos,* four steam launches, and the boats of the fleet. The object of the expedition as set forth in Rodger's orders to Blake was to capture or destroy the Korean forts that fired on the flotilla and to hold them long enough to demonstrate the ability of the Americans to punish the insult offered to their flag.

The expedition got under way about 2 p. m. of the 10th, the steam launch *Weehawken* in the lead sounding the channel, followed by the *Monocacy,* three steam launches, the *Palos* with Blake on board, and nineteen boats containing most of the landing party. About three miles up the river, on the left-hand side, were the first fortifications, called by the Americans the Marine Redoubt. A mile farther up on the same side was Fort Monocacy, and a mile still farther at the bend of the river Fort du Coude or Fort McKee. Opposite the last-named fort across the river was Fort Palos. Concerning the events that look place on reaching the Marine Redoubt Rodgers wrote as follows:

As soon as the *Monocacy* came within good range, she opened upon the enemy's works with shell. The enemy returned the fire for a time, but was soon driven out, and when our landing was made abandoned the position and fled. The *Palos* coming up, the boats pulled in for the shore and effected a landing below the fort. The point chosen for the disembarkation, while seemingly as good as any in other respects, was for military reasons deemed the best, since it flanked the enemy's works and left nothing to be feared in our rear. The character of the shore was unknown and it proved to be most unfavorable for our purpose. Between the water and the firm land, a broad belt of soft mud, traversed by deep gullies, had to be passed. The men stepping from the boats sank to the knees, and so tenacious was the clay that in many cases they lost gaiters and shoes, and even trousers' legs. The guns sank above the axles of their carriages, and it required the strenuous exertions of many men to get them through. The landing was covered by the guns of the *Palos* and the steam launches.

The boats reached the shore at about noon. As soon as firm ground was attained the infantry battalion was formed and the marines deployed as skirmishers. The advance at once began and the first fort was quietly occupied. This fort was constructed of stone; its walls being about twelve feet high; from the upper flank stretched a long water battery. It mounted thirty odd guns, of various calibre; most of them being the small bronze breech-loading pieces of from one to two inch bore, five or six were about eighteen pounders and there were two thirty-two pounders. The destruction of the fort was at once begun. The guns were cast into the river, with the exception of the thirty-two pounders, which were spiked. The walls of the fort were thrown down and the stores of powder, provisions, and clothing burned.

By this time the afternoon was so far gone that it was not expedient to make a further advance on that day. The force therefore went into camp upon a favorable spot in the vicinity of the fort. The marines with one howitzer occupied the position in advance of the main body of the force, and pickets were established to guard against surprise during the night. The Koreans made an attack at about midnight, but it was confined to distant firing upon our lines; and a few shells thrown by the howitzers caused their retreat.[8]

The *Palos* ran on to some rocks, and was of little service to the expedition. After aiding in the reduction of the Marine Redoubt, the *Monocacy* passed up the river and silenced Fort Monocacy. Sailing still farther up, she made preparations to co-operate with the land forces, which at an early hour on the morning of the 11th broke camp and began their advance. They found Fort Monocacy deserted, and after dismantling it, they resumed their march toward Fort du Coude. For the succeeding events Rodger's narrative may be quoted:

The force again moved on. The march was a most difficult one. The country is a succession of steep hills, with deep ravines between, over which foot soldiers passed with great fatigue, while the guns were got on only by widening the paths and by cutting out the bushes and filling up gullies in other places. They were dragged up steep acclivities, by whole companies detailed to help the artillerists, or lowered down from the heights with ropes. A squad of sappers and miners, provided with shovels, picks, and axes, was very useful in facilitating the passage of the artillery, as well as in destroying the fortifications. As the advance continued toward the upper and main fort, large bodies of the Koreans were seen on the left flank of our force, and in such position that, when the direction of our march was changed, as it must be to approach the forts, they would be behind us, and have us cut off from retreat should we be repulsed in the assault upon the forts in front. To guard against danger of an attack upon our rear while engaged in front, five howitzers, with three companies of infantry, under the command of Lieutenant Commander [W. K.] Wheeler, were placed in strong position, which they held as a rear guard during the advance of the main body. Their service was most valuable, inasmuch as they checked several attempts of the enemy to advance, and by their accurate fire prevented a large body from ever getting into action. They also did good service by their fire, directed over our forces, against the forts beyond.

At about 11 o'clock, on the forenoon of the 11th of June, the hill nearest to the enemy's stronghold, or citadel was gained. The *Monocacy* having moved up the river, keeping nearly abreast our land force, had taken position and shelled the forts for some time before our men came up to their vicinity. This fire was continued until our assaulting force was ready,

[8] Asiatic Squadron Letters, 1870-1871, 386-389.

when signal being made, it was discontinued. Behind the crest of the hill which they occupied, our men were formed for the assault upon the citadel, now distant about one hundred and fifty yards, and, covered from the enemy's fire, they rested awhile to recover from the exhaustion of the hurried march under a hot sun. Up to this time, although there had been some brisk skirmishing, but few of our men had been wounded; several had been prostrated by sunstroke. The citadel about to be assaulted, the key to the defenses upon the point below, was built upon the apex of a conical hill, about one hundred and fifty feet high from the bottom of the ravine through which our men had to pass to reach it. The hill-side was very steep; and walls of the fort joined the acclivity with scarcely a break in the line. Had not the face of the walls been somewhat shattered by the shells from the *Monocacy* and the howitzers on shore, the escalade would have been most difficult.

Our men kept up a fire from their resting-place upon the fort whenever an enemy exposed himself, and this they did constantly and with the most reckless courage, for the Koreans maintained an incessant fire, mounting the wall and discharging their pieces as fast as they could load. There was no artillery in the citadel. When all was ready, the order to charge was given by Lieutenant Commander [Silas] Casey, and our men rushed forward down the slope and up the opposite hill. The enemy maintained their fire with the utmost rapidity until our men got quite up the hill, then, having no time to load, they mounted the parapet and cast stones upon our men below, fighting with the greatest fury. Nothing could check our men; on they rushed. The heroic [Lieutenant Hugh W.] McKee was first to mount the parapet, and the first to leap into a hand-to-hand conflict. There he fell, as his father fell in Mexico, at the head of his men, the first inside the enemy's stormed works. Other officers and men were quickly over the parapet. The fighting inside the fort was desperate. The resolution of the Koreans was unyielding; they apparently expected no quarter, and probably would have given none. They fought to the death, and only when the last man fell did the conflict cease. The enemy made no organized resistance in the forts lower down, on the point toward the river. These were opened to a rear attack by the capture of the citadel, and the garrison fled. Many of them, however, fell under the fire of our musketry and howitzers, which had nearly cut them off from retreat.[9]

At about the time the citadel surrendered, Fort Palos, on the opposite side of the river, opened fire upon the *Monocacy*. She returned the fire and soon compelled the enemy to abandon the fort and retreat over the adjacent hills. In all five forts were captured or destroyed; fifty flags and four hundred eighty-one pieces of ordnance were taken, and twenty Koreans were made prisoners. The loss of the enemy was heaviest at Fort du Coude where he had three hundred and fifty men killed and wounded.

[9] Asiatic Squadron Letters, 1870-1871, 390-395.

more than half of them being killed. The loss of the Americans was three killed and ten wounded. The three men killed were Lieutenant McKee, a landsman of the *Colorado,* and a marine of the *Benicia.* The great gallantry of McKee was remarked by all who saw his impetuous charge. He was the first to enter the fort, and fell mortally wounded by a musket-ball in the groin and a spear-stab in the side. The second officer to reach the fort was Lieutenant Commander W. S. Schley, who shot dead the Korean that speared McKee, and who narrowly escaped the fate of his unfortunate comrade. The honor of hauling down the flag of the citadel fell to one of the marines.

On the morning of June 12 the expedition returned to the anchorage of the fleet near the mouth of the river. Its reception has been well described by one who witnessed it:

> The scene on reaching the fleet was one never to be forgotten. The *Monocacy,* gaily decked with captured flags and banners passed close to the *Colorado*'s stern. On the frigate's poop stood Admiral Rodgers, Minister Low, and their staff officers. The little band of sailors who had guarded the ship in our absence, gathered on the forecastle and sent out a joyous shout of welcome. From steamer and boats went back a deafening response, and for some minutes the bay resounded with cheers, music, the ringing of bells, and sounding of steam whistles. Suddenly, as if at a given signal, every voice was hushed, every head uncovered, banner drooped, flags fell to half-mast, and the soft morning breeze seemed vocal with a requiem to the dead. This involuntary tribute to our fallen comrades, so spontaneous, and yet so intensely dramatic, was the closing act of the campaign.[10]

Hoping that the disaster to the Korean arms would move the king to accept overtures for a treaty, Low renewed his attempt to communicate with him. The local officials, however, refused to forward Low's letters to their ruler, who probably never received a true account of the events that happened at the mouth of the Salée. As Rodgers regarded his force insufficient to make its way to Seoul, and as it was doubtful whether such a movement was authorized by the American government, Low decided to discontinue his mission. On July 3 the squadron weighed anchor, and two days later arrived at Chi-fu. On receiving an account of Rodger's operations, the navy department wrote to him approving

[10] Willis, G. R., The Story of Our Cruise in the U. S. Frigate *Colorado,* 80-81.

them, but at the same time cautioned him against undertaking the conquest of Korea.

II.

The Opening of Korea, 1880-1883.[11]

After the return of the Rodgers expedition in 1871, the American government for several years made no attempt to enter into a treaty with Korea. Indeed there appeared to be little or no prospect of success. In 1874, however, our chargé d' affaires at Peking reported that he had received information that a new Korean king and dynasty had come into power, and that they might be regarded as more favorably disposed toward the United States.[12] Two years later Japan made a treaty of amity and commerce with the hermit nation, which opened the ports of Fusan and Gensan to Japanese trade and permitted a Japanese minister to reside at Seoul. The success of Japan encouraged our government to consider the advisability of renewing its overtures. On April 8, 1878, Mr. Aaron A. Sargent, of California, chairman of the Senate committee on naval affairs, introduced in the Senate a joint resolution authorizing the President to appoint a commission to negotiate a treaty with Korea, "with the aid of the friendly offices of Japan." Several days later, this resolution, after a speech by Sargent urging its adoption, was referred to the Senate committee on foreign affairs, from which it never emerged.[13]

There seems to have been some connection between the Sargent resolution and a decision of the navy department, made in 1878,

[11] This chapter is based chiefly on the Shufeldt Papers, temporarily deposited by Miss Mary Abercombie Shufeldt in the Navy Department in Washington; and on the Cruise of the *Ticonderoga*, 2 volumes, to be found in the archives of the department. Of the Shufeldt Papers, the most valuable are the Korean Letter-Book (which contains all the official letters written by Shufeldt from July 1, 1881, to August 23, 1882), and the letters to Shufeldt of the State Department, Minister James B. Angell, and Chargé d' affaires Chester Holcombe. There is in the Shufeldt Papers an unpublished history of the cruise of the *Ticonderoga*.

[12] Secretary of State W. M. Evarts to Secretary of the Navy R. W. Thompson, Nov. 9, 1878, in Cruise of the *Ticonderoga*, U. S. Navy Department Archives, i, 19.

[13] U. S. Congressional Record, vii, part 3, pp. 2324, 2600-2601.

to send Commodore Robert W. Shufeldt [14] on an important commercial and diplomatic mission to certain eastern countries, including Korea. In the fall of 1878 the navy department placed the U. S. S. *Ticonderoga* at the service of Shufeldt for use in this mission. On December 7 she sailed from Hampton Roads for the west coast of Africa. We are not here concerned with the commodore's important work as arbitrator of the boundary between Liberia and the adjacent British possessions, as negotiator of a treaty with the king of Johanna, and as collector of commercial information at the numerous ports visited by him. It may be noted in passing, however, that the *Ticonderoga* entered the Persian Sea and sailed up the Euphrates River, being the first American ship of war seen in those waters. In the spring of 1880 she arrived in the Far East, reaching Hong-kong on March 26 and Nagasaki on April 15.

As early as 1867, when Shufeldt made his first visit to Korea, he conceived the project of opening up that country to the western world. After more than a decade, an opportunity for carry-

[14] Shufeldt had come to be regarded as one of the most eminent diplomatists of the navy and possessed to an unusual degree the confidence of his government. He was born in Dutchess County, New York, in 1822, and at the age of seventeen received a midshipman's commission. After fifteen years of service at sea and on shore, he resigned from the navy to enter the merchant marine. For two years he was employed on board the Collins' ships sailing between New York and Liverpool, and later he commanded several vessels sailing between New York and New Orleans. For a year he was engaged in making an attempt to open a transit route across the Isthmus of Tehuantepec. On the outbreak of the Civil War President Lincoln appointed him consul general to Havana, a post that he filled for two years under most trying circumstances and with conspicuous success. In 1862 the State Department sent him to Mexico on a confidential mission, which seems to have been connected with the occupation of that country by the French. As French troops were in possession of Vera Cruz, it required much tact and discretion to reach the capital and perform the duties required of him. In 1863 Shufeldt again entered the navy, this time as commander; and during the last two years of the war he rendered important service in the naval squadrons off the coast of the Confederacy, participating in several important operations, among others the capture of Morris Island and the attacks on Fort Wagner. His visit to Korea in 1867 has been noted above. Later he commanded a Tehuantepec surveying expedition, and for four years he served as chief of the naval bureau of equipment and recruiting in Washington—L. R. Hamersly, The Records of Living Officers of the United States Navy and Marine Corps (fifth ed.), pp. 25, 26.

ing out his plans had now presented itself.[15] His orders from the navy department required him "to visit some port of the Corea with the endeavor to reopen by peaceful measures negotiations with that government. It is believed that the attack upon the Corean forts in 1871 is susceptible of satisfactory explanation, and that a moderate and conciliatory course toward the government would result in opening the ports of that country to American commerce. You will give special consideration to this subject."[16]

The Department of State approved these orders. It, however, was less sanguine of success than the navy department, and it expressed the opinion that there was no material change in the prospect of entering into a treaty with Korea. Taking advantage of the intimacy between Japan and Korea, it directed Mr. John A. Bingham, the American minister to the former country, to apply to the Japanese minister of foreign affairs for personal or official letters to the Korean authorities, calculated to facilitate Shufeldt's mission.[17]

On arriving at Nagasaki, Shufeldt communicated with Bingham, at Tokio, and was informed that Inouye Kaoru, the Japanese minister for foreign affairs, refused to commend the mission to the favorable consideration of the government of Korea, on the ground that it might produce complications in the execution of the Japanese treaty and that it appeared that the Koreans were still disinclined to open their country to occidental nations. He, however, was willing to give Shufeldt letters to the Japanese officials in Korea, and at Bingham's request he wrote a letter introducing the commodore to Kondo Masuki, the Japanese consul at Fusan, one of the three Korean ports open in 1880 to the Japanese, situated on the southeast coast of the peninsula, some two hundred miles from Seoul.[18]

Accompanied by the American consul at Nagasaki and an interpreter, Shufeldt reached Fusan on May 4, one day from Japan.

[15] Shufeldt, R. W., Corea's Troubles, in the San Francisco *Chronicle*, Oct. 30, 1887, p. 2.

[16] R. W. Thompson to R. W. Shufeldt, Oct. 29, 1878, in Cruise of the *Ticonderoga*, i, 4-5.

[17] W. M. Evarts to R. W. Thompson, Nov. 9, 1878, in Cruise of the *Ticonderoga*, i, 12, 18-22.

[18] Cruise of the *Ticonderoga*, ii, 322-325.

He immediately delivered to the Japanese consul the letter of introduction, and, on the following day, he handed to the consul a letter addressed to the king of Korea and requested him to forward it to Seoul. In this letter Shufeldt attempted to explain satisfactorily the destruction of the *General Sherman* and the events growing out of that incident. He represented his present mission to Korea as a continuation of his former one; he set forth the present motives and objects of the United States; and he requested the king to appoint an officer to confer with him at Fusan. About twenty-four hours later the Japanese consul reported that the governor of the district in which Fusan is situated had refused to forward this letter, saying that he had no authority to forward it and that the Japanese were the only foreigners with whom he could hold intercourse. Balked in this manner, and unable to conceive of any peaceful method of reaching the king from Fusan, Shufeldt returned to Japan.[19]

Arriving at Yokohama on May 11, he at once brought all possible influence to bear on the Japanese government, with a view to inducing it to forward the letter to the king. Finally, after he had held various interviews with Bingham and the Japanese minister of foreign affairs, the last named official consented to cover the letter to the king with one of his own and thus send it to Seoul. Out of deference to the opinion of the minister and to avoid all pretext for hostility, Shufeldt consented to await a reply at Nagasaki for a period of sixty days, instead of proceeding again to Fusan or some other Korean port, as he had contemplated doing.[20] Through the kind offices of the Japanese government the letter to the king finally reached the Korean minister of ceremony at Seoul, who, however, refused to receive it, partly for the reason, as he asserted, that it was addressed to "Great Corai" instead of "Great Chosen." In further explanation of his refusal, he said:

> It is well known to the world that our foreign relations are only with Japan, neighboring to us, which have been maintained since three hundred years, and that other foreign nations are not only situated far from us, but there has never been any intercourse with them.[21]

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[19] Cruise of the *Ticonderoga*, ii, 327-348.

[20] Cruise of the *Ticonderoga*, ii, 349-365, 387-401.

[21] Korean Minister of Ceremony to the Japanese Minister of Foreign Affairs, in Cruise of the *Ticonderoga*, ii, 417-418.

Shufeldt considered the explanation of the minister evasive, and he suspected, rightly or wrongly, that Japan was not acting in good faith. He said:

> It is her policy indeed to monopolize the commerce of Korea. She possesses in that country exterritorial rights and rules the Koreans with an iron rod. Striving to free herself from the obnoxious sway of foreigners upon her own soil, she is unwilling to have these foreigners see how she has imposed these same laws in an aggravated form upon her defenceless neighbor.[22]

In the summer of 1880, while waiting in accordance with his promise to the Japanese government for news from Korea, Shufeldt made the acquaintance of Ü Tsing, the Chinese consul at Nagasaki, who wrote to Viceroy Li Hung Chang, the great Chinese statesman, informing him of the commodore's desire to make a treaty with Korea.[23] Under date of July 23 Li wrote to Shufeldt asking him to come to Tientsin, Li's summer capital, for a personal interview and to talk over matters. "I have heard your name for a long time," said Li, "but I have not yet had the pleasure of seeing you."[24] The invitation was accepted. On August 25, the commodore, having left the *Ticonderoga* at Chi-fu, arrived at Tientsin, and on the following day had a most important interview with Li, concerning which he wrote as follows:

> This interview partook largely of a personal and intimate character, and lasted nearly three hours. His Excellency asked me, first, if there was anything I desired. I told him in behalf of our government I desired that China would use her influence to secure with the Corean government a treaty of amity between Corea and the United States; that this country (Corea) lay directly between America and eastern nations, with which our commerce was in constant communication, and although Corea, I knew, was a poor country and promised but little in itself of commercial importance, yet as it was in the line of ocean travel it was of importance to secure from that government protection by treaty of American lives and property that might be stranded upon its shores. After a prolonged discussion, in which the strategic position of the peninsula of Corea with reference to Russia, China and Japan was pointed out, His Excellency told me that I might say to my government that he would use his influence with the government of Corea to accede to the friendly request made by me in be-

[22] R. W. Shufeldt to R. W. Thompson, Oct. 13, 1878, in Cruise of the *Ticonderoga*, 477-478.

[23] Shufeldt, R. W., Corea's Troubles, in the San Francisco *Chronicle*, Oct. 30, 1887, p. 2.

[24] Li Hung Chang to R. W. Shufeldt, July 23, 1880, in Shufeldt Papers; Cruise of the *Ticonderoga*, ii, 402-410.

half of the government of the United States to open negotiations with a view to such a treaty as before mentioned. For this friendly act I thanked him and assured him that it would meet with the appreciation it deserved. Before closing this subject it was decided that the action of the Corean government would be imparted to the American minister at Peking. . . . His Excellency then said that he had invited me to Tientsin with the view of getting the opinion of a naval officer in whom he had confidence on the result of a war between China and Russia, so far as naval operations on the seacoast of the former were concerned. He begged me to reflect on my answers, because he desired my opinion to have full force and effect not only with himself but in the counsels of the nations. I replied by saying substantially that in view of the formidable Russian naval force, thoroughly drilled and equipped, already upon the coast of China, and in view also of the incomplete and chaotic condition of the Chinese navy, of which I was well aware, the result could only be one of disaster to China. After discussing the crisis from an international point of view, His Excellency seemed much impressed and assured me that war should not occur between these two countries, if China could possibly avert it. He said that the two Empresses and the Prince of Kung, Prime Minister, were decidedly in favor of peace, and that he thought these counsels would prevail.

The result of this interview is necessarily given in brief, but I cannot refrain from expressing my admiration for the intelligence and judgment displayed by His Excellency, Li Hung Chang, and my extreme pleasure in the treatment received from him and the evident respect he entertained for my opinions.

In conclusion he expressed the hope that when peace was assured my government would permit me to assist China in the organization of its navy. This, of course, is a matter to some extent personal in its nature, but if consummated would add very much to American influence in China, and probably end in the construction of ships for that government in American ship yards.[25]

Satisfied that he had placed the proposed negotiations in as good a position as the circumstances would admit, Shufeldt returned home, since the period allotted to the cruise of the *Ticonderoga* was about to expire. He arrived at San Francisco on November 8, 1880. In his opinion, the *Ticonderoga* had inaugurated a movement in Korea similar to that inaugurated by the *Columbus* under Commodore Biddle in Japan, and it only remained for the United States to follow up the movement in Korea with a squadron of ships under a discreet officer, as it had done in Japan. He said that

the acquisition of Alaska and the Aleutian Islands, the treaties with Japan, Sandwich Islands and Samoa, are only corollaries to the proposition that

[25] R. W. Shufeldt to R. W. Thompson, Aug. 30, 1880, in Cruise of the *Ticonderoga*, ii, 466-470.

the Pacific Ocean is to become at no distant day the commercial domain of America . . . . If any means can now be found to get beyond the barred gates and to reach the central government, I am convinced that Corea could be made to understand, not only the policy of a treaty with the United States, but its absolute necessity as a matter of protection against the aggression of surrounding powers. Corea would in fact be the battle-field of any war between China and Russia or Japan, in whichever way these nations might confront each other.[26]

On reaching Washington, in November, 1880, Shufeldt did not lose sight of his great ambition, the opening of Korea to the western world; nor of Li's request that he should serve him in the capacity of naval aide in organizing the Chinese navy. After the commodore left Tientsin in August, he wrote to Li recommending Lieutenant D. P. Mannix, commander of the marines of the *Ticonderoga,* as a suitable officer to give instruction in the use of torpedoes. Li fell in with the suggestion and at once offered Mannix the post of torpedo instructor in the military school at Tientsin. In the spring of 1881 the authorities at Washington, responding to a request from the Chinese government, granted Mannix permission to accept the offer.[27]

In the meantime Shufeldt had been successful in promoting a mission for himself. He urged his government to send him to China for the purpose of aiding Li in organizing the Chinese navy and of making a treaty with Korea by means of Li's assistance. Secretary of State James G. Blaine entered heartily into Shufeldt's plans, and on March 15, 1881, wrote to the Secretary of the Navy that circumstances rendered it desirable that a naval officer of adequate rank and reputation should be attached to the United States legation at Peking, and suggested Commodore Shufeldt as a suitable officer for the proposed service. Shufeldt's objects were to be kept secret, and his position as attache to the legation was to serve as a blind to them. Even our minister to China, Mr. James B. Angell, was not notified of the appointment until the commodore informed him of it in Peking. On March 19, the Secretary of the Navy directed Shufeldt to report to the minister at Peking for special duty, proceeding thence at such time as the Secretary of State might designate. On May 9, Blaine ordered him to leave

[26] R. W. Shufeldt to R. W. Thompson, Oct. 13, 1880, in Cruise of the *Ticonderoga,* ii, 474-481.

[27] Li Hung Chang to R. W. Shufeldt, Sept. 21, 1880; Executive Letters, U. S. Navy Department Archives, xxxiii, 307.

San Francisco on the 19th for Peking, and to stop on his way at Tientsin to ascertain whether the Korean government was ready to resume negotiations for a treaty. On reaching China he was to wait for further instructions respecting Korea. The State Department granted him permission to aid Li in organizing the Chinese navy.[28]

The commodore was accompanied to China by his daughter, Miss Mary Abercrombie Shufeldt, who acted as his secretary. He arrived at Shanghai on June 21, and thence proceeded to Tientsin to see Li Hung Chang, before reporting at Peking. On July 1 Shufeldt had an interview with the viceroy. The latter said that, in accordance with his promise made in the previous August, he had had a conversation with a Korean official in China respecting a treaty between the United States and Korea, and that the official was much impressed with the advantages that his country would derive from such treaty. Li further said that he had written to the government of Korea on the subject but had not yet received a reply. He advised the commodore to exercise patience and expressed the opinion that eventually the United States would realize its wishes. He, however, appeared less enthusiastic than at the previous interview and less willing to act as an intermediary. This change of heart the commodore ascribed to the recent treaty between China and Russia, which lessened Li's dread of Russian aggression. The viceroy was annoyed at an effort which, he understood, had been made by our minister to Japan to persuade Korea to send an envoy to Tokio to confer with our minister respecting a treaty. He said there were two parties in Korea, one in favor of and the other opposed to intercourse with foreigners; and that the king and the court officials belonged to the first of these parties. He expressed his satisfaction with the work already performed by Lieutenant Mannix as torpedo instructor. On the day following this interview, the viceroy returned the commodore's call, and subsequently Shufeldt accompanied him on a visit to one of his men-of-war and witnessed a drill conducted entirely by Chinese officers.[29]

[28] Executive Letters, xxxiii, 377; Secretary of State J. G. Blaine to R. W. Shufeldt, May 9, 1881; C. L. Fisher to R. W. Shufeldt, March 3, 1881; J. G. Blaine to C. Holcombe, Nov. 14, 1881, in Shufeldt Papers.

[29] R. W. Shufeldt to J. G. Blaine, July 1, 1881; R. W. Shufeldt to Secretary of State F. T. Frelinghuysen, Jan. 23, 1882.

On leaving Tientsin, the commodore went to Peking, where on July 7 he presented to Minister Angell his credentials as attaché to the legation. After paying his respects to the Tsung-li Yamen, the Chinese foreign office, he returned to Tientsin, where he established himself, with his daughter in charge of the social affairs of his household, always matters of great importance in the Orient. About the middle of July he had another interview with Li, who, apparently influenced by news of Japanese encroachments in Korea, again manifested much interest in the negotiation of the proposed treaty. He said that he had sent a letter to the Korean government of such import that it would at least elicit a reply, if it should not be the means of the appointment of a Korean official to consult with respect to a treaty. He expected a reply within ninety days, and he asked the commodore to remain at Tientsin to receive it and to meet the Korean official, should one be sent there.[30]

During the remainder of the summer and all of the autumn of 1881 Shufeldt was at Tientsin, awaiting news from Korea. He had expected Li to take some action regarding his offer of a responsible post in the Chinese navy, but the viceroy found it advisable to avoid that subject. For a time, however, he frequently consulted Shufeldt respecting naval affairs and often adopted his suggestions. The commodore's constant visits to Chinese ships of war and arsenals created a general impression that he was to take charge of the Chinese squadron of the North. This aroused the envy of some of the foreigners in the Chinese service, and several of the foreign ministers at Peking used their influence to prevent his employment. Responding to the pressure that they brought to bear, Li became less and less communicative respecting naval matters; and finally Shufeldt, in order to maintain the dignity of his rank and station, declined to have any further connection with the Chinese navy.[31]

The period of ninety days fixed by Li as sufficient for the reception of news from Korea expired about the first of October, and no news had been received. Shufeldt's position now became exceedingly embarrassing, and the question arose whether under the

[30] R. W. Shufeldt to J. B. Angell, June 18, 1881; R. W. Shufeldt to F. T. Frelinghuysen, Jan. 23, 1881.

[31] Korean Letter-Book, 7-10, 23-24, 27-28; C. Holcombe to R. W. Shufeldt, Nov. 9, 1881; J. G. Blaine to C. Holcombe, Nov. 14, 1881.

circumstances his dignity would not be sacrificed by his remaining longer at Tientsin, where to outsiders he appeared as a hanger-on to Li's court and a solicitor of a naval job. Minister Angell advised his departure, and Mr. Chester Holcombe, the American chargé d' affaires, who in October succeeded Angell at Peking, was inclined to agree with his predecessor.[32] The Commodore, however, decided to remain until he heard from Korea.

Finally on December 15, Shufeldt received a call from the viceroy's naval secretary, who was sent by his master to say that a Korean official had reached Tientsin bringing the information that Korea was now willing to make a treaty with the United States. The commodore replied that he would communicate the intelligence to his government at Washington, that if it wished to make a treaty it would appoint a commissioner, and that the negotiators probably could not begin work until spring. Not only the necessity of waiting until the American government appointed a commissioner, but also the fact that Li was about to depart from Tientsin to Pao-ting-fu, his winter capital, made a delay imperative. On receiving this news Shufeldt sent it to Holcombe to be telegraphed to Washington. Soon after its receipt there, Secretary of State Frederick T. Frelinghuysen, who had succeeded Blaine, telegraphed these words to Holcombe: "Congratulate Shufeldt on prospect of successful negotiation."[33]

The commodore was disappointed in not receiving additional instructions from his government in respect to Korea in the summer or fall of 1881. The assassination and death of Garfield, however, had more or less interfered with the plans of the administration. When he received information of Korea's willingness to negotiate, he was not aware that his government had already appointed him a special envoy to Korea and had authorized him to negotiate a treaty with that country. His instructions were signed by Secretary Blaine on November 14, and his letter of credence by President Arthur on the following day. He was also provided with a letter written by the President to the King of Korea. Rear-admiral Clitz, the commander-in-chief of the Asiatic squadron, was directed to place a vessel at his service. On Janu-

[32] J. B. Angell to R. W. Shufeldt, Oct. 14, 1881; C. Holcombe to R. W. Shufeldt, Nov. 26, 1881.

[33] R. W. Shufeldt to C. Holcombe, Dec. 16, 1881; F. T. Frelinghuysen to C. Holcombe, Jan. 7, 1882.

ary 6, 1882, the new Secretary of State wrote to him increasing his powers, giving him a few additional instructions, congratulating him on the auspicious beginning of his mission and expressing appreciation of the friendly aid received from Li.[34]

Shufeldt's prime purpose, according to his instructions, was to obtain a treaty for the relief of American vessels and crews shipwrecked on the Korean coast. However, should he find the temper and disposition of the king favorable, he was also to negotiate a treaty of amity and commerce, securing rights of trade, fixing tariffs, establishing consular and diplomatic representation and granting ex-territorial jurisdiction. He was cautioned not to ask for too much, as the initial treaty might well serve as a first step in opening a hitherto closely sealed country. He was ordered not to begin negotiations unless there were reasonable prospects of success. In carrying out his instructions he was left largely to his own discretion. His stay in Korea, however, was limited to two months.[35]

Shufeldt did not receive the Blaine instructions until January 19. Four days later he wrote to Li, who was still at his winter capital, informing him of the action of the Washington government and suggesting the propriety of meeting him at such time and place as he might select. The viceroy replied that he would be glad to see the commodore at Pao-ting-fu, provided he would come incognito. This he declined to do, as he did not wish to give the negotiations the character of a personal intrigue between himself and the viceroy. It was then settled that the interview should be postponed until Li's return to Tientsin in March.[36]

The prospects for a successful outcome of the mission seemed highly flattering. There was danger, however, that complications might arise. It was known that the viceroy had urged the British minister at Peking to inaugurate a negotiation with a view to a treaty between England and Korea.[37] Fortunately for Shufeldt the governments at both Peking and Seoul now showed the greatest interest in the opening of Korea to intercourse with the western

[34] J. G. Blaine to R. W. Shufeldt, Nov. 14, 1881; President Arthur's letter of credence dated Nov. 15, 1881; F. T. Frelinghuysen to R. W. Shufeldt, Jan. 6, 1882; R. W. Shufeldt to J. M. B. Clitz, Jan. 20. 1882.

[35] J. G. Blaine to R. W. Shufeldt, Nov. 14, 1881; F. T. Frelinghuysen to R. W. Shufeldt, Jan. 6, 1881.

[36] Korean Letter-Book, 17-20, 42-44, 46.

[37] Korean Letter-Book, 74.

nations. Not Li alone, who was inclined to represent himself as the prime agent in bringing together the contracting parties, but the Chinese government also was supporting the movement to open Korea, as may be seen from the following extract from a letter of Holcombe, dated February 4, 1882:

> I was at the Yamen—the Foreign Office—on Wednesday last, and sounded the Ministers on the Corean question. They responded more readily and freely than I had anticipated, and told me some things which surprised and pleased me and which explain Li's course in the Corean question.
>
> All matters concerning Corea have in past years been attended to by the Board of Rites here, the oldest, highest, and most intensely anti-progressive of the Six Boards. The Yamen told me that last spring, through Prince Kung's influence, Corean questions were transferred from the Board of Rites to the Foreign Office; that the Emperor of China himself wrote a letter to the King of Corea, urging him to establish treaty relations with Foreign Powers, and first with the United States; that Li was simply ordered to forward that letter; that the King of Corea had replied that he was willing and even anxious to negotiate with the United States. They added that the King and a large proportion of the people of Corea understand the situation and are ready for foreign intercourse, but that there is there, as in China, an anti-foreign party.[38]

Early in February Shufeldt went to Peking to confer with Holcombe. As the latter had resided in the Far East for several years and was an accomplished Chinese scholar, it was agreed that he should attend the interview with Li. His presence, it was thought, "would perhaps render Li himself a little more cautious, and consequently reliable," and would place a check on Li's "exceedingly slippery interpreters." Shufeldt again visited the Tsung-li Yamen, and found it quite cordial and eager to aid him in his negotiations. Before returning to Tientsin, he and Holcombe prepared a draft of a treaty with Korea (draft No. 1). This contained no reference to China's claim to suzerainty over Korea, on the inclusion of which, it was well known, the viceroy was determined to insist.[39]

On the arrival at Li at his summer capital, about the middle of March, it soon appeared that the terms of the treaty were to be virtually settled at Tientsin and not in Korea, and that the viceroy

[38] C. Holcombe to R. W. Shufeldt, Feb. 4, 1882.

[39] R. W. Shufeldt to C. Holcombe, Dec. 4, 1881; C. Holcombe to R. W. Shufeldt, Jan. 31, 1882; R. W. Shufeldt to F. T. Frelinghuysen, March 11, 1882.

was to represent both his own government and that at Seoul. With the latter he kept in touch by means of its representative in Tientsin, who stayed in the background and who had no formal connection with the negotiations. "I have every reason to believe," wrote Shufeldt on April 10, "that there is at this moment in Tientsin a Korean official who is consulted at every step." [40]

The negotiator on the part of China and Korea, Li Hung Chang, was easily the most powerful man in the Chinese empire and in large measure dominated its foreign policy. He was viceroy of Chili (the province in which Tientsin is situated), senior guardian of the heir apparent, grand secretary, commander-in-chief of eighteen provinces, commissioner of coast defenses, etc., etc. Shufeldt described Li as he appeared at this time, somewhat unsympathetically it is true, as follows:

He is fifty-nine years of age, six feet two inches in height; has a clear, cold, cruel eye and an imperious manner. He is a thorough oriental and an intense Chinaman. These imply contempt for western nations and hatred for all foreigners. Li Hung Chang is the Bismarck of the East; he keeps together an incongruous empire and an effete dynasty by the repressive force of an indomitable will. He suppresses rebellions by decapitation and quiets the turbulent with the bamboo; yet he is great, not because he is so much in advance of his countrymen, but because he is not so far behind as they are in an appreciation of the arts political and physical which govern the modern world. He at least recognizes the value of these forces; he buys ships of war, constructs forts, experiments in torpedoes and drills troops with modern arms.[41]

On March 25, accompanied by Holcombe, Shufeldt held the first of a series of interviews with Li. Concerning what took place at this meeting, he wrote to the Secretary of State as follows:

His Excellency authorized the following statement, which I told him I intended forwarding to Washington.

The King of Corea and his prime minister are in favor of opening the country to foreigners, and are not only willing but anxious to treat with the United States, but there is a faction at court and among the people intensely hostile to the movement. A Corean envoy has recently visited His Excellency at Pao-ting-fu, and it was then determined to ask the Corean King to send an ambassador to China for the purpose of making a treaty with the United States, under the supervision of His Excellency the Viceroy, and to return to Corea when I go to that country for its ratification.

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[40] R. W. Shufeldt to F. T. Frelinghuysen, April 10, 1882.

[41] R. W. Shufeldt to A. A. Sargent, Jan. 1, 1882, in Korean Letter-Book, 32-33. See also San Francisco *Evening Bulletin*, March 20, 1882, p. 3, and other American newspapers of about the same date.

To facilitate this arrangement I have transmitted a draft of a treaty to the Viceroy, such as I thought would accord with my instructions, and His Excellency in return has presented one, which, while stipulating for the quasi-political dependence of Corea, is yet not by any means incapable of being reconciled with our own demands.

On Saturday next [April 1], I am to present my objections to this draft to the Hai-kwan-Taotai, who is empowered to discuss the question with me.

Both Corea and China are anxiously looking for protection against the growing aggression of Japan on the peninsula. In this connection the Viceroy informed me in the strictest confidence that the King of Corea would now be glad to see an American man of war in the Seoul River, and His Excellency advised me by all means to go to that point and to get as near the capital as possible. . . .

I informed His Excellency that the United States had now been waiting more than a year for the action of the Chinese authorities in the matter of Corea, that the proposition to intercede came from His Excellency, that the United States had accepted it in the friendliest spirit, and that I hoped there would be no delay in the action foreshadowed; and I further told him that if there was no prospect of success by May 1st, prox., I should telegraph to the State Department and advise the abandonment of the project. His Excellency said that he had promised me his assistance in this matter, and he intended to fulfil it to the extent of his power.[42]

On exchanging the first drafts of the treaty (drafts Nos. 1 and 2), it was apparent that the only important differences between the negotiators related to the first article as drafted by Li, and especially to Li's inclusion of the following sentence: "Chosen, being a dependent state of the Chinese Empire, has nevertheless heretofore exercised her own sovereignty in all matters of internal administration and foreign relations."[43] At an interview, held on April 1, between Shufeldt and the hai-kwan-taotai, Li's principal assistant, the latter made the commodore's assent to the Chinese draft of article 1 the *sine qua non* of any further discussion of the treaty. The Commodore refused his assent and the interview came to an end. Shufeldt now prepared "draft No. 3," a combination of Nos. 1 and 2, with the objectionable features left out; and Li prepared "draft No. 4," a combination of 1 and 2, with the objectionable features left in. At an interview held at Li's yamen on the 5th, the viceroy declared that article 1 was indispensable, that the instructions of his government made its inclusion imperative and that it was written at the desire of the king of Korea. Shufeldt then read an argument against its inclusion.

[42] R. W. Shufeldt to F. T. Frelinghuysen, March 30, 1882.

[43] Draft No. 2, in Shufeldt Papers.

He submitted that, since Korea (as asserted in article 1), was in possession of sovereign powers in respect to its foreign and domestic relations, the United States had the right to treat with her independent of the suzerainty of China. He declared that a reference to China was not pertinent to the treaty, that it might cause complications, and that he had no power to connect the United States with China as the joint protector of Korea. Subsequently, after a considerable discussion of the question, Li asked for four days in which to consider it.

By the 10th the treaty seemed to be practically completed, as the viceroy had agreed to waive article 1, provided the commodore would make a request in writing for a messenger to accompany him to Korea as the representative of the Chinese government and would state in the request that, owing to the fact that Korea was in a certain sense a dependent of China, he had asked for the intervention of the Chinese authorities for the accomplishment of the purpose in view. To this proposition Shufeldt was willing to assent. He also promised to forward to the President of the United States a letter, which was to be written by the king of Korea and after the treaty was signed, stating that the treaty had been made by and with the consent of the government of China.[44]

Subsequently to reaching these agreements, the question of the inclusion of article 1 was again brought up for discussion, and at one time so procrastinating were the tactics of the Chinese and so serious was the breach between the negotiators that Shufeldt threatened to break off the negotiations and proceed to Chi-fu. His spirited stand brought the Chinese to terms, for they were as desirous as he that the treaty should be made.[45] The cause of the failure of Li's proposition respecting the waiving of article 1 and the result of that failure are thus set forth by the commodore:

> This proposition would have been agreed to, if, during an interview between Mr. Holcombe and the Foreign Office at Peking, that office had not proposed to him whether in some way less positive the suzerainty of China over Corea might not be mentioned in the treaty. To this proposition Mr. Holcombe did not see the objections which had occurred to me. Conse-

[44] R. W. Shufeldt to Li Hung Chang, April 4, 1882; memorandum of R. W. Shufeldt dated April 6, 1882; R. W. Shufeldt to F. T. Frelinghuysen, April 10, 1882.

[45] Shufeldt, Miss M. A., The Treaty with Korea, 8-10, in Shufeldt Papers; rough draft of Shufeldt's ultimatum to Li Hung Chang (undated), in Shufeldt Papers.

quently the Foreign Office addressed a letter to the Viceroy on the subject, and out of deference to the wishes both of the Foreign Office and of His Excellency the Viceroy, although contrary to my own judgment, I sent to the Department on the 12th inst. the following telegram: May I insert in treaty with Corea an article admitting dependence of Corea upon China, China conceding sovereign powers to Corea. They desire it. I have objected. Answer.[46]

By April 19 the treaty was completed in every particular except one, the question of the admission of the suzerainty of China. On that day Shufeldt telegraphed the Secretary of State as follows:

Business arranged, except subject cipher telegram [refers to telegram of the 12th]. Ready start for Corea. Must have interpreter. Suggest Holcombe. His assistance very necessary. Thirty days probably sufficient. Can you send him, putting Taylor in charge of archives at Peking?[47]

For several days Shufeldt awaited replies to his telegrams, but no replies came. Under date of January 20 he had written to the department, asking for authority to employ an interpreter, but his request was not attended to. Much vexed at the strange action of his superiors in Washington, he made preparations for his departure to Korea. He and Li agreed, tacitly or otherwise, to abide by the compromise measures originally accepted in lieu of the exclusion of article 1. From Tientsin he went to Shanghai and thence to Chi-fu, where he arrived on May 4. Here he found the U. S. S. *Swatara,* Commander P. H. Cooper, detailed by Rear-admiral Clitz for Korean service, and three vessels of the Chinese navy, under the command of Admiral Ting. Here had also arrived the representative of the Chinese government, Ma-Kiet-chong, an expectant taotai of the honorary title of the second rank. This official informed the commodore that Li had forwarded a copy of the proposed treaty to the king of Korea, and that it did not contain the objectionable article, which the commodore feared Li might insert. At an interview with Ma it was agreed that the Chinese vessels should leave for the mouth of the Salée, or Seoul, River on the morning of the 7th, and the *Swatara* twenty-four hours later—an arrangement that was carried out.[48]

At seven o'clock on the morning of May 8, the commodore and his Chinese interpreter having come on board, the *Swatara* got under way for the coast of Korea. Her departure caused much

[46] R. W. Shufeldt to F. T. Frelinghuysen, April 28, 1882.
[47] R. W. Shufeldt to F. T. Frelinghuysen, April 28, 1882.
[48] Korean Letter-Book, 63-68.

commotion among the foreign vessels in the harbor, several of which hastened to send dispatches to their ministers at Peking.[49] At 2.15 p. m. of May 12 she anchored at the mouth of the Salée River, a little below Roze Island, and found there the Chinese corvette *Wei-Yuen,* bearing the flag of Admiral Ting, two other Chinese vessels and the Japanese gunboat *Banjo.* On the following day Ma, who acted as intermediary between the Americans and Koreans, called on Shufeldt to arrange for a visit of two Korean commissioners who had been appointed by the king to " negotiate " the treaty.

The principal commissioner, Shin Chen, president of the royal cabinet, had negotiated the Korean-Japanese treaty. His colleague was Chin Hong Shi, a member of the royal cabinet and formerly an envoy to Japan.[50] On the 14th these two officials, attended by their staff and an interpreter, visited Shufeldt, and were received with a salute of three guns, the courtesies of the ship being extended to them. They were exceedingly friendly in their expressions of good will, and after their return ashore they sent aboard presents of rice, eggs, fowls and beef. Six days later Shufeldt, accompanied by several officers, visited the commissioners at a place in the interior about six miles from the ship, called Yin Chuen. Here the credentials were examined and found satisfactory, and the commodore presented the commissioners with Arthur's letter to the king, insisting that it should be delivered as a message from a sovereign ruler of a friendly nation and answered in the same terms. It was here settled that two days later a meeting should be held on shore, in sight of the *Swatara,* for the purpose of sealing, signing and delivering the treaty which had been perfected at Tientsin.[51] Concerning this last formality, which took place on May 22, the commodore made the following memorandum:

May 22: At 9.30 a. m. Commodore Shufeldt, accompanied by Commander P. H. Cooper, Lieutenants E. C. Pendleton and H. R. Tyler, Surgeon J. A. Hawke, Paymaster H. T. B. Harris, Chief Engineer A. Adamson, Ensigns W. F. Fullam, W. G. David and P. V. Lansdale, Cadet Midshipmen J. R. Maloney, H. B. Andrews and H. L. Ballentine, and Cadet Engineers,

[49] Shufeldt, Miss M. A., The Treaty with Korea, 10-11; Rear-admiral J. M. B. Clitz to the Secretary of the Navy, May 17, 1882.

[50] Korean Letter-Book, 69-70.

[51] Korean Letter-Book, 61-74; Log of *Swatara,* in Shufeldt Papers; P. H. Cooper to J. M. B. Clitz, May 30, 1882, in Asiatic Squadron Letters.

W. F. C. Hasson and C. A. E. King, and preceded by the marine guard of the U. S. S. *Swatara*, under command of First Lieutenant W. F. Spicer, left the ship and proceeded to the place previously selected for the signing of the treaty between the United States and Corea, which was on the mainland near the town of Sai-mots-fo [Chemulpo?] and in full view of the ship at anchor in Roze Roads. He proceeded at once to the tent which had been put up by the Corean authorities, finding there the two commissioners on the part of Chosen, Shin Chen, president of the Royal Cabinet, and Chin Hong Chi, member of the Royal Cabinet, with their suite, and Ma Taotai, and Admiral Ting and Captain Clayson of the Imperial Chinese Navy. After a little preliminary conversation, the six copies of the treaty, three in English and three in Chinese, were sealed and signed by Commodore Shufeldt on the part of the United States, and by the two commissioners already named on the part of Chosen. As soon as the signing was completed, at a signal from the shore, the *Swatara* fired a salute of twenty-one guns in honor of the king of Chosen. Commodore Shufeldt and party then returned on board the *Swatara*.[52]

The treaty that was signed in Korea, with the exception of a slight modification of article 8, was identical with the one negotiated with Li at Tientsin.[53] The "negotiations" in Korea consisted of but little more than the sealing and signing of a document already agreed to by the three interested parties. Shufeldt gained the point for which he so vigorously contended, that the treaty should contain no recognition of the claim of China to suzerainty. Two days after the signatures were appended, he received a letter from the king, addressed to the President, which contained the following significant acknowledgment: "The Chou Hsion country (Corea) is a dependency of China, but the management of her governmental affairs, home and foreign, has always been vested in the sovereign."[54] He also received a friendly letter from the king addressed to the President, a reply to the letter of President Arthur. Both of these documents he forwarded to the State Department.

Mention must be made of the interest manifested by the Japanese in the negotiating of the treaty. On Shufeldt's arrival at Roze Roads on May 12, the commander of the Japanese gunboat *Banjo* delivered to him a letter from our minister to Japan, Mr. John A. Bingham, introducing him to Mr. Hanabusa, the Japanese minister at Seoul, with whom, wrote Bingham, I have no doubt that you

[52] Korean Letter-Book, 74-75.
[53] R. W. Shufeldt to F. T. Frelinghuysen, Aug. 23, 1882.
[54] Korean Letter-Book, 79.

will find it to your advantage "to cultivate intimate and, if need be, confidential relations." This letter called forth a letter from Shufeldt to Hanabusa. In Hanabusa's letter of reply to Shufeldt, occur the following suggestive words: "I was waiting for your arrival there [Roze Roads] wishing to speak something about our relations with Coreans, etc., but I had been obliged to enter Seoul without any delay for some urgent business, but I think I can visit you within four or five days." On Hanabusa's return to Roze Roads Shufeldt reached the conclusion that Japan regretted her declination two years before to act as intermediary between the United States and Korea, and that she was now anxious to retrieve her error. Hanabusa watched every movement of the negotiators, and "was only prevented from offering his services by the sudden and to him unexpected conclusion of the treaty." [55]

On the morning of the 24th the *Swatara* sailed for Shanghai, where she arrived on the evening of the 26th. Here the commodore was employed several days preparing translations of the Korean documents, before forwarding them to the State Department. On June 4 he arrived at Nagasaki, where he remained several weeks, hoping that an arrangement might be effected whereby he would succeed Read-admiral Clitz as commander-in-chief of the Asiatic squadron. Failing in this, he sailed for San Francisco, arriving there on July 29, 1882. As his arduous and exacting duties had impaired his health, he remained in California several months before proceeding to Washington.

The reasons for the failure of the State Department to reply to Shufeldt's telegrams present several points of interest. One cause of its failure may possibly be traced to the publication, on or about March 20, 1882, in various papers throughout the United States, of the famous Shufeldt-Sargent letter. On January 1, Shufeldt wrote a long letter to his friend, Senator Aaron A. Sargent of California, in which he spoke with great freedom of the Chinese government and people and of Li Hung Chang and the Empress. Through a misunderstanding this letter was given to the press, and its publication was exceedingly embarrassing to the administration. Frelinghuysen characterized it as an "extra-

[55] J. A. Bingham to R. W. Shufeldt, April 26, 1882; R. W. Shufeldt to Hanabusa, May 12, 1882; Hanabusa to R. W. Shufeldt, May 17, 1882; R. W. Shufeldt to F. T. Frelinghuysen, June 8, 1882.

ordinary letter, brutal in its frankness."[56] The incident naturally caused considerable coldness between Shufeldt and the Secretary of State. There seem, however, to have been other reasons for the procrastination of the department at a crucial moment in the negotiations. Shufeldt was an appointee of Blaine, between whom and Frelinghuysen no love was lost. The latter apparently was not loath to have the Korean treaty consummated by an appointee of the Arthur administration, Mr. John Russell Young, the new Minister to China. It is said that, when Young on his way to his station heard in June at Nagasaki from the commodore that the treaty had been signed, he could not conceal his profound disappointment.[57]

The Korean treaty was transmitted by Arthur to the Senate on July 29, 1882, and was ratified on January 9, 1883. Ratifications were exchanged at Seoul on May 19, and the treaty was proclaimed on June 4, 1883.[58] Already the first American Minister to Korea, Mr. Lucius H. Foote, had arrived at the capital and had been received by the king and queen with much distinction and courtesy. Before the end of the year a Korean embassy visited the United States, where many attentions were shown it by both government and people.

The Korean treaty was much more comprehensive than the initial treaties of either our own government or other occidental governments with China and Japan, which were little more than shipwreck conventions. In January, 1882, Frelinghuysen wrote to Shufeldt that if he obtained only a shipwreck convention his mission would yield admirable results. He was cautioned not to try to gain too many or too great advantages.[59] Disregarding this advice, Shufeldt negotiated a treaty of "peace, amity, commerce and navigation," quite comprehensive in character and containing fourteen articles. Among its important provisions are those permitting American citizens to trade at the open ports of Korea

[56] A. A. Sargent to R. W. Shufeldt, April 26, 1882; Secretary of the Navy W. E. Chandler to R. W. Shufeldt, June 2, 1882; R. W. Shufeldt to W. E. Chandler, rough copy, undated, probably about July, 1882; G. M. Robeson to R. W. Shufeldt, June 4, 1882.

[57] Conversation with Miss M. A. Shufeldt; C. Holcombe to R. W. Shufeldt, May 15, 1882; Korean Letter-Book, 10-11.

[58] Sen. Ex. Doc., No. 47, 48 Cong. 2 sess., p. 216.

[59] F. T. Frelinghuysen to R. W. Shufeldt, Jan. 6, 1882.

and to erect residences and warehouses therein, fixing rates of tariff, granting the usual privileges contained in shipwreck conventions, establishing diplomatic and consular representation, prohibiting traffic in opium, giving to American consuls in Korea extraterritorial jurisdiction, and granting to the United States the privileges obtained from Korea by the most favored nation.[60]

The success of Shufeldt's mission attracted little attention in the United States, indeed much less than his unfortunate letter to Sargent. Our people knew little or nothing of Korea and were not yet interested in the politics of the Far East. With the ruling powers at Washington the commodore was out of favor. President Arthur did not mention him in his message to Congress, and the State Department was none too prompt or cordial in expressing its appreciation of his services.[61] As a result of the indifference of the people and the disfavor of the government, the commodore never received the recognition in America that was legitimately due him.

Other nations, and particularly those having interests in the Far East, were quick to see the importance of his achievement. Within a few weeks after the signing of the American treaty, Great Britain and Germany made treaties with Korea, and these countries were soon followed by Italy, Russia, France, Austria and China, all of them accepting the commodore's work as a model for their own. The similarity between the feat accomplished by Perry in Japan and that by Shufeldt in Korea is so obvious that it has been frequently commented upon. One of the earliest of the comments is by a leading London journal,[62] and another by a fellow officer of Shufeldt, the commandant of cadets at the Naval Academy. "The making of the treaty," wrote that officer, "will place you in history beside Perry, and when your detractors will have long been forgotten your name will still shine brighter than ever."[63] Without attempting a comparison between the work of our two great sailor diplomats, it may be said that their

[60] For the text of the treaty, see Sen. Ex. Doc., No. 47, 48 Cong. 2 sess.

[61] Acting Secretary of State W. Hunter to R. W. Shufeldt, Sept. 6, 1882. See also correspondence in the Shufeldt Papers respecting the reception of the Korean embassy in Washington, in September, 1883.

[62] Quoted in John W. Foster's American Diplomacy in the Orient, 326.

[63] Commander N. H. Farquhar to Commodore R. W. Shufeldt, Aug. 8, 1882.

treaties are the most notable successes of the American navy in the peaceful field of diplomacy.

The opening of Korea was the consummation of Shufeldt's diplomatic career. His government, however, had still one more important duty for him to perform, the inauguration of the work of constructing the new navy. From 1882 to 1884 he served as president of the Naval Advisory Board, which had this work in charge. He also served for a time as superintendent of the Naval Observatory. He was retired as rear-admiral in 1884, and eleven years later he died, in Washington.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE EVOLUTION OF LEAD-LINED PIPING ON SHIPBOARD.

By Naval Constructor R. D. Gatewood, U. S. Navy.

There is probably nothing on a modern man-of-war that causes as much constant trouble both for the ship's force and the navy yard as the various piping systems. Certainly there is nothing upon which "all the law and the prophets" have so often disagreed both as to the cause of the failure of the pipes and as to the means for preventing it.

Before describing the process which is believed to be the last, or rather the latest, word toward the removal of the difficulties, it may be of interest to review the history of the corrosion on board ship of the non-ferrous metals used in these systems together with the results of some of the leading investigators of this subject.

Instances are on record in the early 18th century of serious corrosion of the iron fastenings of vessels sheathed with lead, which sheathing was accordingly abandoned and copper, with copper fastening, used in its place.

Occasional cases of serious corrosion of copper sheathing still arose and Sir Humphry Davy about 1820 conducted some experiments along preventive lines, the results of which were to show that the sheathing was perfectly protected when the ratio of its area to that of the protective metals, iron or zinc, was approximately 1000 to 1. For a while this form of protection was used but it was found that the iron or zinc required very frequent renewal and the sheathing thus protected was much more easily fouled by marine growth than when not protected, and the scheme was abandoned.

In 1832 Muntz metal replaced copper as sheathing, and for a long time there was comparatively little trouble with sheathing or

piping except in isolated instances and many officers now living can well remember the pride with which the chief engineers of the old navy would exhibit the highly burnished copper piping in the bilges at Sunday captain's inspection.

When iron and steel came to be universally adopted for hull construction a new problem arose. The copper pipes, bilge water, and steel floors and angles and the shell formed an excellent electric battery and very serious corrosion of the electro-positive steel resulted as a consequence of which copper pipes in the bilges were reduced to a minimum. There is an instance of a vessel that was run ashore to prevent her sinking from a hole in her shell caused by a copper strainer in a bilge suction pipe.

Another period of comparative immunity ensued until the general introduction of electricity on shipboard, and from that time until the present the trouble has been constantly increasing. The increased steam pressures occurring about the same time were frequently blamed for some of the difficulties, but in the light of the modern electrolytic theory of corrosion they may safely be eliminated as a cause.

Nature of the Action.

The action occurs in the valves and piping of the fire, flushing, drainage and fresh-water systems, and in the tubes of condensers and distillers. It takes several characteristic forms, among the most common of which are as follows: Sometimes the pipe is eaten through in pin-holes; sometimes the holes are as large as one-half square inch in area with sharp, clean-cut edges as though punched; again they are pitted and honeycombed as though the pipe had a disease similar to smallpox; and still again there are long clean-cut longitudinal grooves in the tubes or pipes. Corrosion is found generally at or near the bends, branches and valves. In the case of ordinary piping the pits or holes are usually found in the top of the pipe and near the flanges while in condenser tubes about 80 per cent of the pitting is found in the bottoms. Throughout the whole phenomenon the action has been found to be exceedingly erratic. Under conditions where corrosion has been found to be most virulent cases are encountered which, while apparently similar in every respect, show most excellent states of preservation.

The Principal Facts Established by Early Observers.

The causes for the above observed results are the subject of much controversy and the literature on the subject while voluminous is contradictory and confusing in the extreme. Out of the maze of it all the following may be considered as the facts established prior to the exposition of the electrolytic theory of corrosion:

1. Corrosion is due largely to electrolytic action. (No adequate cause was assigned for this fact.)

2. Corrosion is accompanied in practically all cases by dezincification, that is the zinc that was in the metal is eaten out.[1]

3. Pitting is due to any one or all of the following causes: (1) local segregation of impurities in the metal, (2) the presence of deposits of impurities such as carbon, lead, iron, etc., derived from outside sources, and (3) the presence of stray electric currents.

4. Tin, when present in brass or copper in solution up to 1.5 per cent, or when plated, retards corrosion.

5. The longitudinal grooves are due to the fact that certain impurities are drawn out along the surface of the tube during the process of manufacture.

6. Electrolytic copper although the purest of metal (the writer has had analyses made that show it to be 99.96 per cent pure), is more readily corroded than brass or copper made by the usual process. This is a striking fact because other things being equal, the purer and more homogeneous a metal the less liable is it to corrosion.

7. Electrolytic copper should not be used in the manufacture of Muntz metal.

8. When material is strained as in unequal cooling of the surface or where the metal is upset and bruised as in riveting, corrosion is much more rapid.

9. Thick tubes or pipes are more resistant than thin ones.

10. Corrosion is accelerated by increasing the temperature of either the metal or the solution in which immersed, hot sea water being much more effective than cold.

11. The presence of air and carbon dioxide increases corrosion.

[1] Condenser tubes that analyzed when new, tin 1.06, copper 70.36 and zinc 28.57 per cent gave the following analysis after four years in use: tin 2.06, copper 89.6, zinc 7.4.

Means of Prevention.

A knowledge of these facts has resulted to produce many and varied recommendations as to the best means to be adopted to prevent corrosion, the most important of which, up to about 1905, are the following:

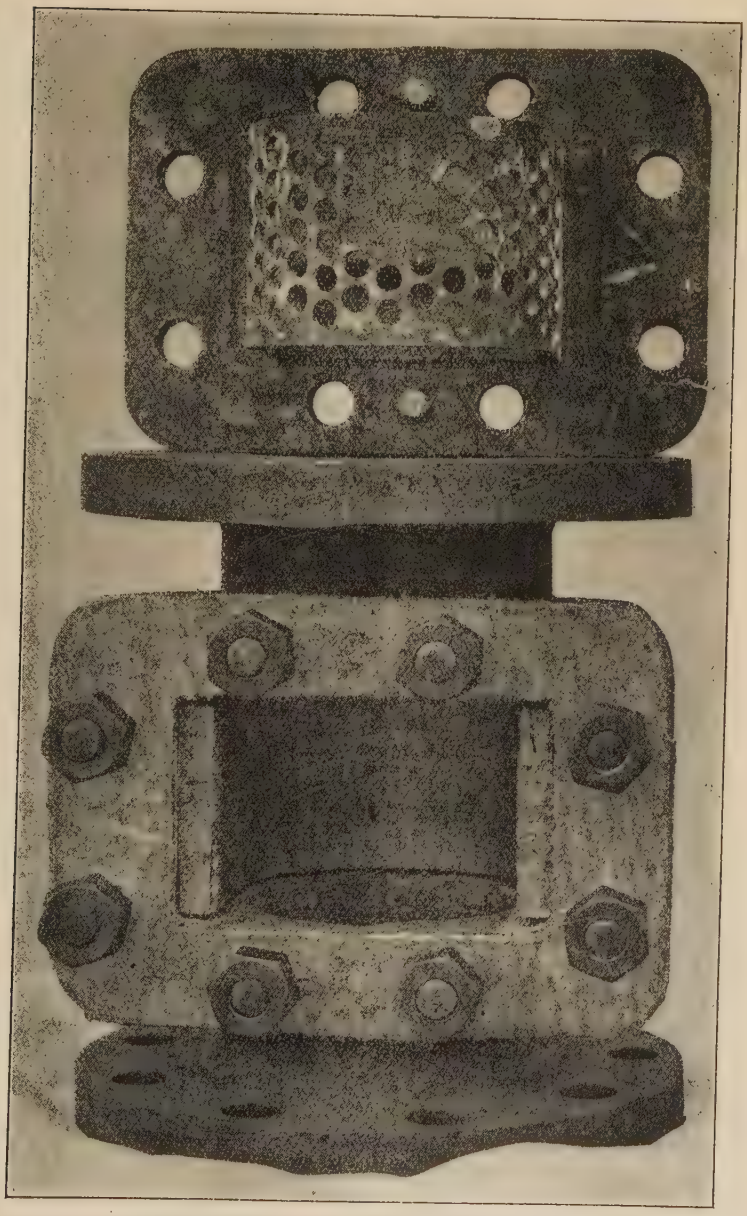
1. The use of the more electro-positive metals such as sheets or slabs of iron and zinc in direct metallic contact. Our navy uses zinc slabs inserted in zinc boxes installed in pipe lines from 30 to 40 feet apart. A photograph of this type of box is here shown. The British use cast iron freely. This they say is equally as effective on account of better metallic contact and being much cheaper and easier to insert, which they do by means either of cast strips and rods let in among the tubes in condensers or short lengths of cast iron pipe in their piping systems.

2. The use of some form of coating to protect the surface of the metal from contact with sea water. One school of engineers and chemists advocated the use of non-metallic coatings, such as marine glue, varnish, lacquers, asphalt, porcelain and special forms of cement and wax. The best known form of this type was that called the Sabin process, named from its inventor Professor A. H. Sabin, and used extensively for several years in our navy. The process was expensive, involving as it did very careful cleaning of the pipe, dipping into a patented hot liquid coating and baking in a special oven at a constant temperature with the pipe on end. Properly applied it did protect the piping but like all other coatings of this nature, it eventually cracked, scaled or eroded off with consequent clogging of small branches, valves and strainers, and further, in those spots where this occurred the corrosive action was materially intensified. For these reasons it was abandoned.

Another school advocated the use of metallic coatings and the most common were tin, lead, and tin-lead alloys. Until the present lead-lining process was perfected it was very difficult to apply these as entirely unbroken coatings free from pin-holes that seriously increase the corrosive action. Also they were not durable owing to their slight thickness.

3. It was recommended that the tubes or pipes be kept free from foreign particles by being constantly cleaned out, a proceeding as difficult as it is expensive.

4. Every care was to be used in preventing the access of stray electric currents to the piping or tubes.



Standard Zinc Box.

5. Care was to be taken in the manufacture (1) to obtain a homogeneous mixture, (2) to prevent the presence of any impurities, and (3) to produce metal with an absolutely smooth surface, free from air holes and strains due to cooling or mechanical working.

Electrolytic Theory of Corrosion.

The above was about the extent of knowledge on the subject prior to the advent, about 1906, of that very satisfying theory of corrosion known as the electrolytic theory which was largely due to the researches of the American investigators, Cushman, Gardner, and Walker. It was about this same time that the present process of lead-lining was begun in earnest and since then very considerable progress can be reported.[1]

The most important additions to our knowledge of corrosion phenomena due to the application of this theory are:

1. All metals and alloys when in contact with dilute acid or water, either pure or containing salts in solution, tend to pass into solution in the form of ions.[2] This tendency is known as the solution pressure of the metal and each one has a definite and characteristic solution pressure in a given solvent which depends only on (1) the temperature and (2) the number of its own metallic ions in the solution.

2. Ordinary metals dissolve or are corroded because they are not chemically and physically homogeneous.

3. A perfectly homogeneous metal will not corrode appreciably in pure water. The reason for this will be given in a later paper. It is practically impossible to obtain an absolutely pure metal free from strains by any means now employed. It will corrode slightly, but so slightly that the amount cannot be measured. (For explanation of corrosion of pure electrolytic copper see later.)

4. Metals and alloys may with some minor exceptions be arranged in a definite order in which they tend to pass into solution. This order corresponds, interestingly enough, with the order

[1] The writer hopes to be able to describe the details of this highly interesting and now generally accepted theory in a future paper covering the latest researches in the field of the corrosion of iron and steel and, although it would be very appropriate at this place, must reserve until then an account of what has been aptly termed "the mechanism of corrosion" in the light of this theory.

[2] An ion is an atom or group of atoms charged with static electricity.

of electro-positiveness of the metals and for the ordinary metals and oxygen and hydrogen is as follows: Zinc, iron, tin, lead, hydrogen, copper and oxygen.

5. Opposing solution pressure there is another real pressure of considerable magnitude known as osmotic pressure, which is that due to the tendency of the ions dissolved off to pass back into their former state of metallic atoms, and may be readily pictured as corresponding to the pressure of a gas on the walls of its containing vessel. The pressure tends thus to prevent the entrance of more ions into solution.

6. A metal or alloy will be corroded by a solution that contains ions of a more electro-negative nature than the metal or alloy itself. Thus, referring to the above list of metals, zinc will corrode rapidly in a solution of copper ions, iron will corrode slowly in a solution of lead ions (on account of the nearness of the two metals in the electro-positive scale), etc.

7. When an ion of a metal passes into solution it takes on a positive electric charge leaving a negative one on the corroding metal. Now this negative charge sometimes, as in the case of water, attracts a positively charged hydrogen ion that is in the water and tends to form on itself a plating of hydrogen which will hinder further action. If though there be present in the metal or solution a substance such as oxygen, or air, which will combine with the hydrogen to form water and thus remove it from the surface of the corroding metal, it will give up its positive charge when it thus combines with oxygen, thus neutralizing the negative charge on the zinc, another ion of the zinc will be thrown off at this point and the action will thus be accelerated. Such a substance which removes hydrogen is called a "depolariser."

8. Our old conception of corrosion by means of galvanic action must thus be completely reversed. Ordinary corrosion is not primarily the effect of an electric current but is rather the *cause* of the current.

9. The conceptions of solution pressure and osmotic pressure may be likened to those of gravitation and a resisting medium in space. By means of the two latter the theory of the formation of the worlds has recently been practically solved.[1]

[1] Researches on the Evolution of the Stellar Systems, Vol. II, 1910, by Professor T. J. J. See, U. S. N. Thos. P. Nicholls & Sons, Lynn, Mass., publishers.

By means of the two former much will be accomplished toward the attainment of that other goal toward which so many minds are now bent—the conservation of our national resources.

10. The new idea of the function of the impurities is (1) that they act to raise or lower the solution pressure of the metal or (2) as depolarisers and increase corrosion, or even in the opposite sense and so retard corrosion, or (3) to produce negative and positive areas in the metal.

11. The rapid corrosion of electrolytic copper has not yet been satisfactorily accounted for. Analysis of this copper made at Mare Island Navy Yard shows:

Iron	.02
Arsenic	trace
Lead	trace
Copper	99.97

And it would be an ideal material for resisting corrosion. The most plausible theory so far advanced is that of Bengough: "Such copper almost invariably contains a certain quantity of hydrogen gas, absorbed, or in solid solution, or present in a definite compound, and the presence of this gas may, perhaps, be the cause of a greater tendency to corrosion than that shown by ordinary best select copper." The same investigator, however, admits that the ordinary less pure copper may be protected by the presence of small quantities of a protecting impurity such as tin or arsenic.

Practical Tests of Bureau C. & R.

Keeping the above facts in mind it will be of interest to see the results of certain practical tests that have been made.

(a) *Comparative test on three different vessels.*—In this connection the Bureau of Construction and Repair about 1905 instituted the following test to determine the relative merits of the three forms of piping: (1) pure copper uncoated, (2) pure copper sabined, (3) pure copper tinned. The three armored cruisers *Milwaukee, California* and *South Dakota* were fitted with fire and flushing systems installed throughout in one of the above ways. Tinning proved to be the best but when the coating once began to wear off the pipe corroded as readily if not more readily than either of the others and required extensive repairs at the end of 18 months. The sabined copper and the pure copper were about equally bad, leaving out of account the very considerable incon-

venience caused to a vessel in full commission by the constant clogging of small branches and valves due to particles of the sabine coating.

(b) *Sabined copper pipe and copper pipe with iron wire inside.*—In June, 1905, tests were made at the New York Navy Yard with copper pipe protected by the insertion of an iron wire in the form of a helix in contact with the pipe. A 6-foot length of standard copper pipe 6 inches in diameter was fitted with a helix of wire, size ¼ by 1/16 inch with 6-inch pitch, the end of the wire being soldered to the inside to avoid lateral movement. The ends of the pipe were flanged and blank flanges fitted. These blank flanges were tapped for ½-inch galvanized-iron pipe connections. Sea water furnished the circulating pump of the power plant was run through the copper pipe continuously by means of the small end pipe connections. The test was started June 23, 1905. On November 25 the pipes were removed for examination. The iron wire had disappeared entirely except for a section about 18 inches in length near the outer end of the pipe, which was corroded so that the size was reduced to ⅛ by 1/64 inch. The interior of the pipe contained about 1 quart of muck and a thin film of iron oxide remained on the inner surface. The copper itself was in practically the same condition as at the start, there being no loss of weight.

The test was continued and made a comparative one between similar sections of copper pipe, one plain and the other sabined. The original pipe was fitted with a new helix of iron wire and all three were set up with blank flanges and 1-inch inlet and outlet pipes as originally arranged. The new test was started on April 15, 1906. On November 9, 1906, the pipes were examined. All three pipes were half filled with muck and small shells. The plain copper pipe showed a moderate amount of corrosion near the ends, but was in good condition along the middle. The pipe coated by the Sabine process was in as good condition as when installed; the interior was, however, covered with barnacles and shells. The copper of the pipe fitted with the iron helix was in excellent condition, showing practically no pitting, but the iron wire had disappeared completely except for a length of about 3 inches, which on being touched crumbled into rust. In view of the fact that the wire helix disappeared in so short a time, and to the consequent impracticability of renewing the wire on board ship at such short intervals, no further tests were made.

(c) *Lead-lined pipe at the Norfolk Yard.*—In 1906 experiments were made by Naval Constructor Stocker at the Norfolk Navy Yard that resulted in the present method of lead-lining. Experience with lead- and tin-lined linings had been confined to screwed connections which had proven more or less unsatisfactory at the joints. Mr. Stocker's idea was to use seamless drawn steel tubing, galvanized to increase life against external corrosion, lined with an unbroken coating of lead forced by high pressure into intimate contact with the tubing, using throughout *only flanged joints*. The success of this method was clearly demonstrated by the following facts:

(d) *Electrolytic tests of various pipes at the navy yard, New York.*—At the New York Navy Yard extensive electrolytic tests were undertaken in 1906-7 with various kinds of protected pipes. These included plain copper, sabined copper, galvanized iron, galvanized iron with zinc box, and plain brass. All the pipes were connected to a brass header at one end, the other end being blank-flanged with a small screwed outlet connection. Water was supplied the header through a rubber hose. The pipes were supported on wooden chocks insulated with sheet rubber. The five pipes were connected in parallel with a storage battery of 300 ampere hours' capacity. The voltage of this battery varied from 2 to 1.8 volts from charge to discharge, but by means of the resistance wire and the rheostats in the circuit it was possible to maintain practically a uniform current. The connection of the pipes to the header was made to resemble as nearly as possible the conditions on ship, these connections being of composition, representing the pump and pump cylinders. In each case a large globe valve was connected to the pipe at the header end. The following was the calculated division of current in the pipes (it being assumed that the resistances of the pipes remain unchanged) during the first period of the test:

Pipe No.	Amperes.
1. Copper pipe	1.00
2. Galv. iron pipe without zinc box	.378
3. Galv. iron pipe with zinc box	.359
4. Brass pipe	.608
5. Copper pipe sabined	.191

In December, 1907, the pipes were examined and showed the following results of test: The brass pipe at the valve end had an almost continuous circle around the extreme edge of large pits

about ⅛ to 3/16 inch deep by ¼ to ½ inch long in addition to a number of well-defined deep pit-holes, some as large as ⅛ by 3/16 inch deep. The entire length of pipe had a bright surface similar to brass treated with acids, due probably to the zinc of the composition being eaten away and leaving the bright copper lustre. The outlet end of this pipe was not noticeably affected. The large brass globe valve lying between the pipe and header was badly eaten around the valve seat, especially at right-angles to the direction of the pipe. This pitting had the appearance of wormholes about 3/16 inch deep by ¼ inch wide by ½ to ¾ inch long, showing bright red metal. The valve proper was not so badly affected but was pitted around its contact surface. The galvanized iron pipe protected with zinc box was in excellent condition and even some of the galvanizing still existed. The valve end was in excellent condition and even some of the galvanizing still existed. The valve end was not affected, there being only a very thin coating of rust. There was no pitting, and the threads were in perfect condition. At the outlet end there was a very slight pitting and a somewhat thicker coating of rust. The pipe was in practically perfect condition as regards pitting, although the galvanizing was, except in a few places, gone. The zinc ring in the box was eaten away more than when last examined, especially where the two halves meet, but was still serviceable. The large globe valve was in excellent condition. The unprotected galvanized-iron pipe was in a badly corroded condition at the valve end. The thread was practically all eaten away, and a coating of rust about 1/16 inch deep extended toward the interior of the pipe. At the outlet end the thread was in good condition, and there was only a very little pitting with only a very thin coating of rust. The globe valve leading to this pipe was slightly pitted around the valve seat and around the contact surface of the valve proper, but not near so badly as in the case of the brass-pipe valve. The plain copper pipe at valve end showed slight pitting around the edge of same, also a thin coating in spots of green oxide of copper which when scraped off showed a bright surface underneath. The other end showed slightly more needle-like pitting, but no green oxide. There were about 6 pit-holes about 1/16 inch diameter by 1/32 inch deep. The globe valve leading to this pipe was in excellent condition, there being only very slight pitting on both the valve seat and the valve proper. The sabined pipe coating was in poor condition,

especially near the ends where the pipe was nearly entirely exposed. Through the middle of the pipe the coating was in better condition, but was broken in spots. The coating could be easily peeled off in large sheets and showed considerable flexibility. The valve and seat were in good condition. This pipe had been in actual service since April 15, 1906, having been taken from the former test in comparison with the pipe fitted with the iron helix. It was in such excellent condition at that time that it was not resabined, but connected up with the above pipes at the start of the present test on December 3, 1906.

3. There had also been connected up in parallel a length of pipe lined with lead as per process described as in vogue at the Norfolk Navy Yard. This pipe had been in service from February to December and showed no signs of deterioration.

Reviewing these tests it is evident that aside from lead-lined pipe, the most serviceable and economical method for protecting pipes is to employ zinc boxes in connection with galvanized-iron piping. In connection with this method it is to be noted that since the above pipes had been in service the small composition valves and fittings connected with the outlets of the pipes had to be renewed because of corrosion causing bad leaks, except in the case of the iron pipe with the zinc box. The outlet valve on the brass pipe would require renewal before connection could again be made. The above tests indicated that the Sabine coating was unsatisfactory compared with the excellent results obtained from using a zinc box, or even of employing a plain copper pipe. The plain brass pipe and the galvanized-iron pipe without zinc box were unsatisfactory because of excessive pitting and corrosion.

4. On further examination in May, 1908, it was found that the lead-lined pipe had suffered no injury, the lead lining being in perfect condition.

From the above it is clear that lead-lined pipe is superior to all others for use on shipboard. The next in importance is galvanized-iron pipe with zinc boxes. The other pipes are distinctly inferior.

Further test was made by installing the same length of lead-lined piping on the *Tacoma* in May, 1908. When examined a year later it was found to be in perfect condition.

(e) *Tests on Kentucky, Kearsarge and Louisiana.*—Three sections of lead-lined flushing pipe were fitted in the crew's head

of the *Kentucky* in December, 1906, and when removed and examined in April, 1909, were found to be in good condition, with the exception of a slight deposit on the surface of the lead pipe. There was no sign of corrosion or pitting.

On the *Louisiana* five sections of lead-lined flushing pipe were fitted in the crew's head and one section in the fire main between frames 9 and 11 under the protective deck, port side, in December, 1907. These when removed were found to be in excellent condition with the exception of the same slight deposit as cited above on the *Kentucky*. Four sections of lead-lined pipe were installed in the fire main and flushing main on the *Kearsarge* in November, 1906, and on examination in April, 1909, were found to be practically in as good condition as when installed, and it is believed that the lead lining will be good for at least five years more. In one or two of the sections examined it was noted that there was a slight tendency of the lead lining to draw toward the ends of the pipe, caused, no doubt, by the expansion and contraction of the pipe and lining.

The marked superiority of lead lined pipe having been thus clearly shown, it was adopted by the Bureau of Construction and Repair for all salt-water pressure piping above 1½ inches in diameter.

Description of its Manufacture.

In repairing pipe lines brass, iron and copper piping may be lined, but for new work lap-welded steel casing (being much cheaper than seamless drawn tubing and equally as satisfactory) is used. The inner surface of this casing is first made entirely smooth by a revolving chain mop on a flexible spindle attached to a pneumatic drilling machine. In the case of old piping this is first cleaned and the pits closed by solder, wiped off smooth, and tested to a pressure of 300 pounds.

All joints are made with flanges. When repairing a pipe having several different bends it is sometimes necessary to cut the pipe at the bend and fit flanges. The flanges are counter-bored to about ¾ inch from the face of the pipe, depending on the size of the flange, and about 1/10 inch deep, or the thickness of the lead which is to be flanged over, *care being taken that the edge of the casing over which the lead is bent is carefully rounded with a file.*

The lead tubing used is about ¼ inch smaller than the pipe to be lined. Where bends are encountered it is necessary to pull the lining through. This is done by means of a rope led through the lead tube and then through a plug and secured by a knot. The lead tubing is then filled with dry sand by means of the machine

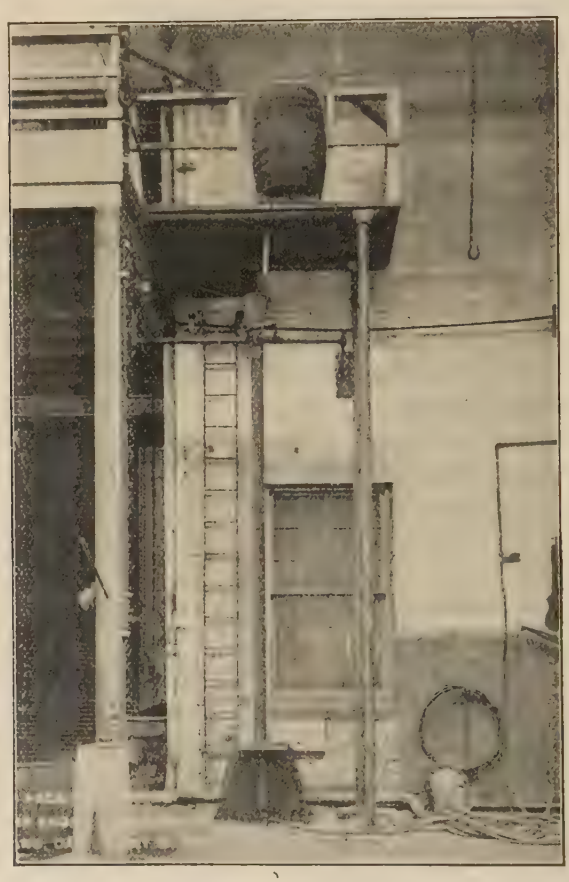


FIG. 1.—Sand Packing Machine.

shown in Fig. 1, covered with tallow and while the outer tube is tapped with a wooden mallet, pulled through by means of the machine shown in Figs. 2, 3 and 4,[1] operated by air or water pressure at from 15 to 100 pounds pressure according to the nature

[1] These machines were designed by Leadingman J. T. Murphy, in charge of the pipe shop at the Mare Island Navy Yard.

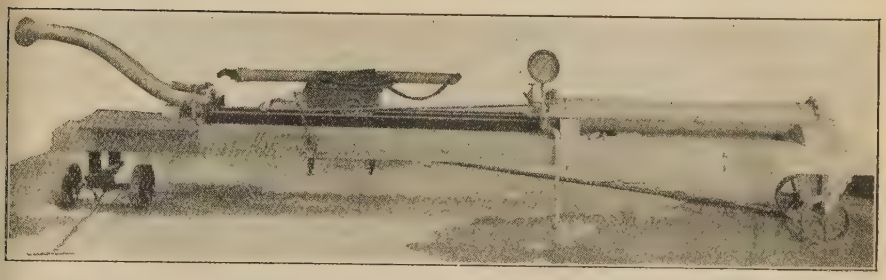


FIG. 2.—Lead-Lining Machine. Lead on Rear Table Ready to Pull in Pipe.

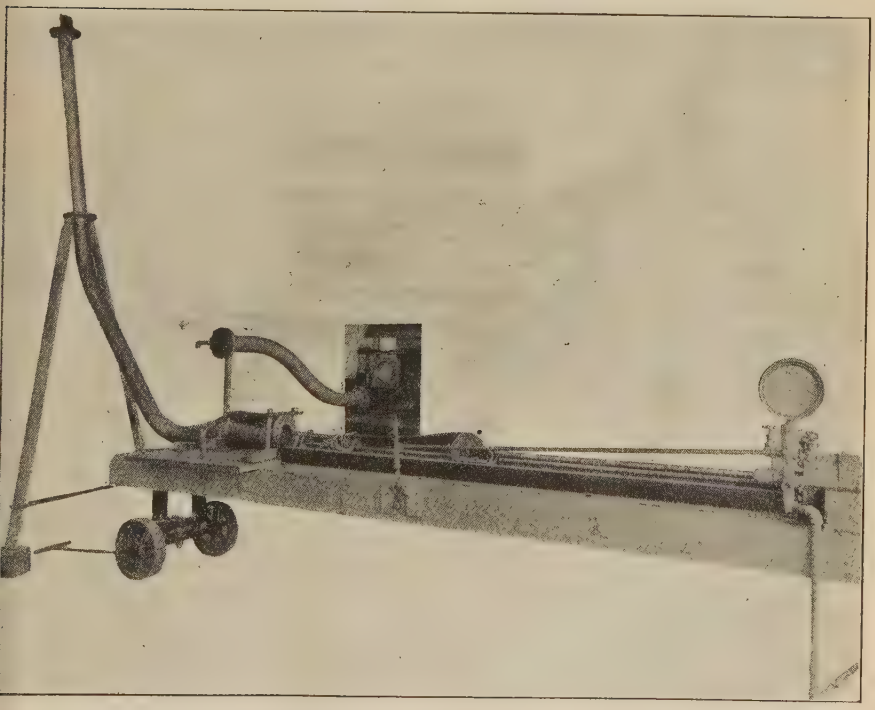


FIG. 3.—Lead-Lining Machine. Pulling Lead in 4-inch Copper Pipe.

of the bend. Bad bends are warmed slightly by means of a gasoline torch.

The plug, sand and rope are then removed and the lead examined by inserting a small electric portable. If no defects appear

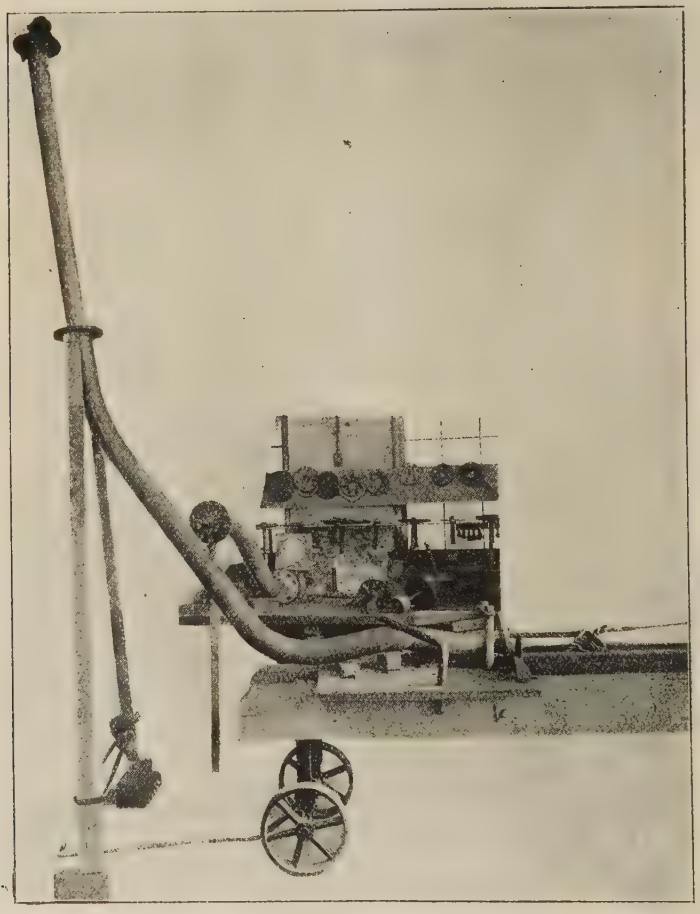


FIG. 4.—Lead-Lining Machine. Pulling Lead in 4-Inch Copper Pipe.

the tubing is tapped over into the recess of the flange at one end of the pipe only. The other end of the lead pipe is sawed off about 6 inches longer than the pipe that is to be lined and the plug shown in Fig. 5 is fitted.

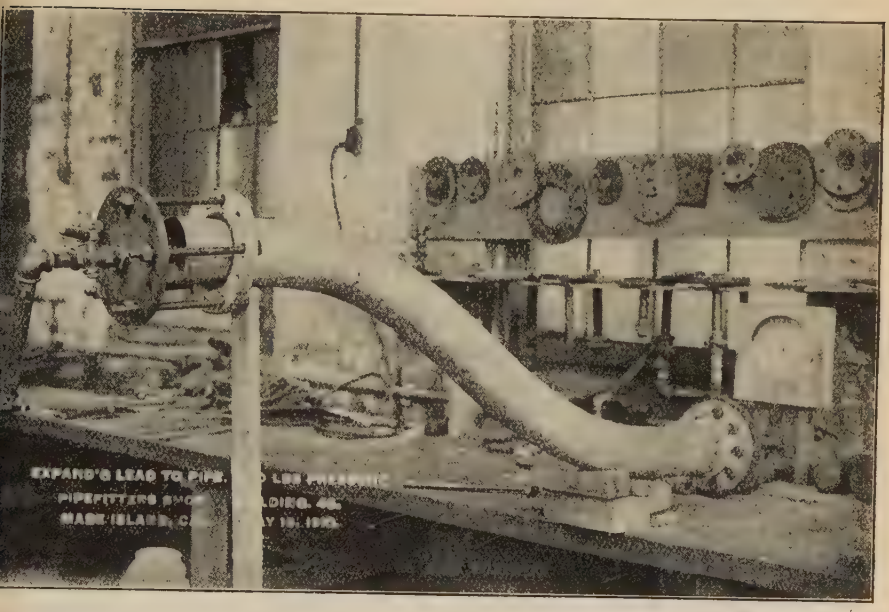


FIG. 5.

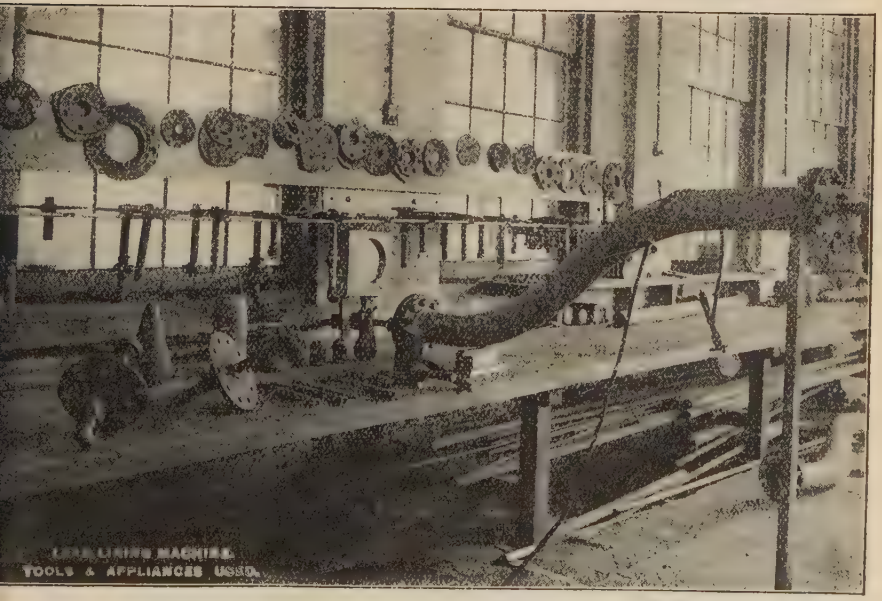


FIG. 6.—Applying Final Pressure of 600 Pounds.

The air cock shown is opened and the pressure turned on slowly. When the air is all out the plug is closed and the pressure very gradually run up to 300 pounds. The lead pipe becomes shorter under this pressure which is then removed and the lead fitted into the recess of the flange at the other end of the pipe. The piece of piping is then blank-flanged and treated to a final pressure of 600 pounds per square inch. See Fig. 6.

WEIGHT AND COST.

In order to reduce weight the lining should be no thicker than absolutely necessary. For sizes given in the following table the weight and thickness there given have been found very satisfactory:

Outside diameter of pipe.	Weight of pipe.	Thickness.
1½"	2	.088
2	3	.099
3	4	.088
4	5¾	.095

The weight of such a system is about 5 per cent less than that of a similar installation of copper piping. The cost is about 50 per cent less.

Further Points of Interest Thus Far Determined.

1. The lead piping should be shipped from the works of the manufacturer very carefully packed on wooden mandrels to prevent crushing and distortion.

2. In the case of galvanized iron, wrought iron or steel tubing, the elbows, tees and other fittings are not lead lined. It has been found necessary to lead line fittings under no circumstances.

3. Old pipe has been lined with lead where the radius of the bend was twice the diameter, but it is better practice to bend the tubing to be lined to about 4 or 5 times the diameter.

4. In relining old copper pipe it is much cheaper to reline the old pipe even though it is necessary to cut out the brazed flanges and substitute flanged fittings.

5. The process does not work well on pipe above 5½ inches on account of the crushing of the lead tubing when drawing it into the steel casing.

6. Lead-lined piping is not adapted to suction pipes. The suction pulls the lead away from the walls of the steel casing.

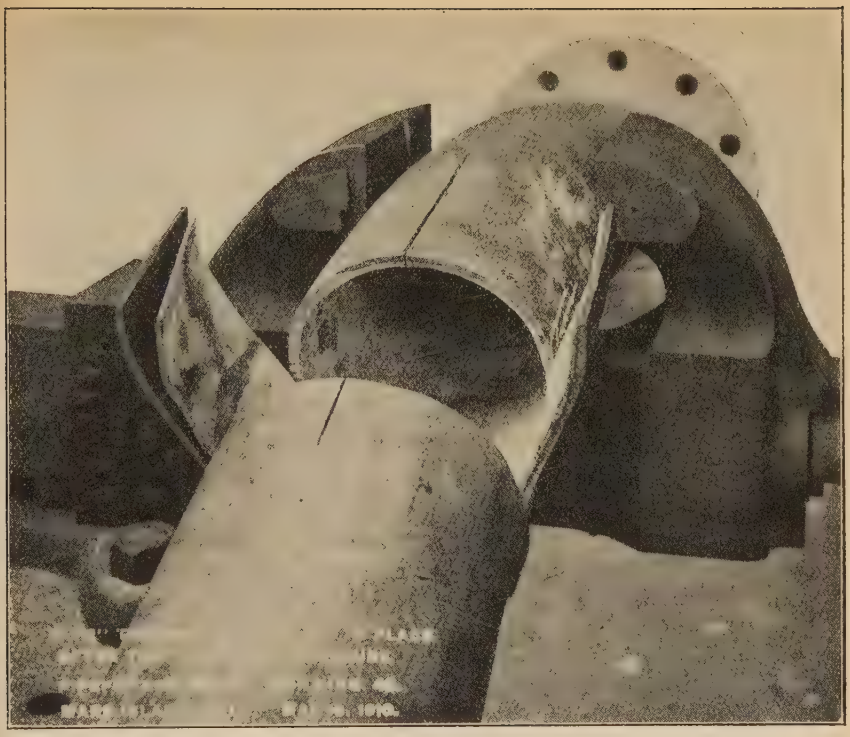


FIG. 7.—Showing Intimate Nature of Contact of Lining with Tube.

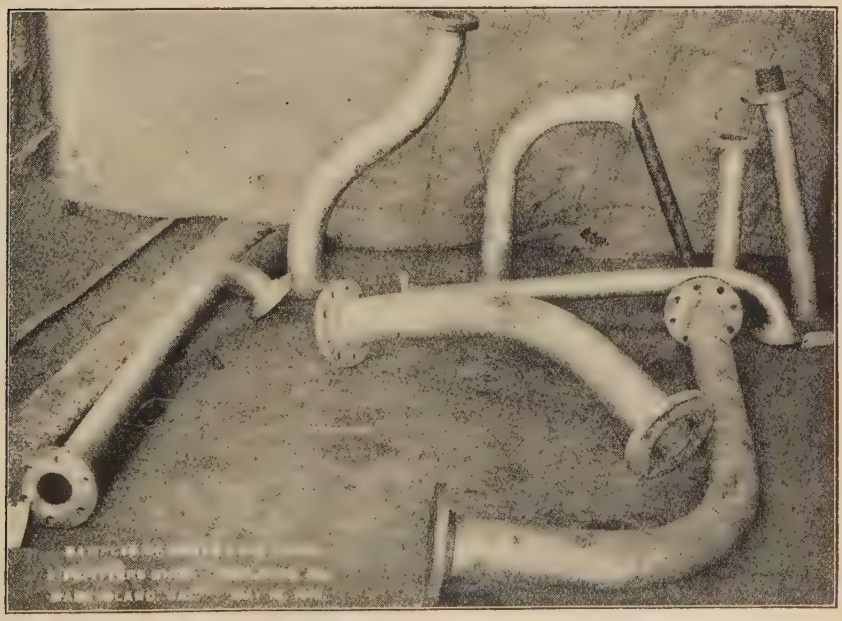


FIG. 8.—Samples of Lead-Lined Bends.

7. Lead-lined piping is not adapted for use with very hot water or steam service such as bottom blow piping for evaporators, on account of the large expansion in those cases.

8. Thickness of tubing thinner than that given in the above table should not be used. Considerable difficulty has been experienced on recent torpedo boat destroyers in the attempt to save weight in this manner.

9. Special care should be used to give no crown to the lead where expanded over the recess of the flange. Unless a perfectly flush surface is thus obtained it has been found that in setting up the joint the pressure comes on the lead causing it to separate from the flange recess or to crack where bent over the steel casing.

10. Several cases of severe lead poisoning have occurred at Mare Island due to the milky oxide of lead on the outside of the tubing getting into the pores of the skin of the workmen and all the usual precautions should be taken to guard against this form of poisoning.

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THE REPRESSION OF PIRACY IN THE WEST INDIES. 1814-1825.

By Captain Carlos Gilman Calkins, U. S. Navy (Retired).

Any tale of pirates has a far-off, romantic sound to men of the twentieth century; and neither naval nor diplomatic programs need take much account of their pursuit. It was not so when our government was organized and our navy was granted ships and men. While the Constitution awaited ratification Jefferson planned an international league to suppress the Barbary corsairs; and Madison had the same rovers in mind when he wrote in *The Federalist* of the danger that our richest port might become a hostage "for the imperious demands of pirates and barbarians." Since greater complications might follow should war begin in Europe "and all the unruly passions attending it be let loose upon the ocean," he argued that a union capable of maintaining a navy was essential for the protection of our commerce and the restraint of our citizens who might disregard the obligations of neutrality. Jefferson was in power when a squadron had to be sent to Tripoli; and Madison had to deal with the corsairs of Algiers and the filibusters of the Gulf of Mexico as soon as he made peace with Great Britain in 1815. The problems which confronted his successor involved most of the phases of his vision of 1787—which had been partially realized during the war of maritime reprisals with France at the close of the eighteenth century. The service rendered by our navy in policing the seas which skirt the shores covered by the Monroe Doctrine were a necessary preliminary to the President's declaration; and the earlier measures of repression had a direct bearing upon the rectification of our southern boundaries. The naval chronicle of the Monroe administration is therefore a significant chapter of our national history; and it is by no means lacking in picturesque pages and racy anecdotes.

Few of these can be presented in detail, since the harder task of drafting an outline of the successive campaigns will exhaust the available space. The shorter contest with Tripoli, which cost far less in life and money and had little influence upon our national development, has been voluminously discussed and romanticized. The West Indian story has to be treated in a simpler and more objective fashion. The mangrove swamps and coral reefs of the Bahama Channels are somehow on a lower imaginative plane than the northern margin of the Saharan Desert; and though the men who sailed with Commodore Porter—let it be remembered that Farragut was one of them—had their full share of hazard and adventure. But the climate was so much more deadly than the fighting, the mortality from yellow fever so much greater than that due to the malice of pirates, that a raid or a skirmish was a trivial matter in comparison with the hardships of a summer's cruise. At any rate, most of the reports are sober and modest, and even the journalists of the days failed to reap a sensational harvest. For crudely romantic treatment of the story, one may turn to the novels of Michael Scott: *Tom Cringle's Log* and *The Cruise of the Midge* abound in local color, but, as Marryat said, they are too melodramatic. The rank flavor of the Smollet tradition may account for the strict reserve with which these works are handled in the Boston Public Library, but they are sometimes misplaced among the juveniles in less careful collections. For solid fact, however, one must resort to prosaic volumes of *American State Papers,* with some help from the *Register* published by Niles in Baltimore.

I. Colonies of Adventure in the Gulf of Mexico and Florida. 1814-1819.

The rovers who sought bases for predatory operations among the islands of our southern coast were rarely professed pirates. Filibusters they might have owned themselves to be, had that term been taken in its modern sense as describing revolutionary interlopers; but to the Spaniard, filibuster and pirate still had but one meaning. Moreover, the treaty between the United States and Spain left Americans who cruised under letters of marque from any enemy of Ferdinand VII subject to the penalties of piracy. Afloat or ashore, any partisan of the revolution in Spanish America was regarded as a brigand by the royalist leaders

and punished accordingly when captured. To this Spanish custom the modern distinction between the filibuster and the pirate is doubtless due. Letters of marque from insurgent *juntas* or commissions in unorganized navies were of some advantage in our harbors, but they did not cover the sale of prizes in a neutral port. This had been decided, once for all, in the controversy about French privateers before 1800. The partisans of the independence of Spanish America were tempted to seize unguarded islands within trading distance of American towns in order to support their belligerent cruising by the clandestine sale of prize goods. Smugglers were not yet outlaws to the population of Georgia or Louisiana; but when the corsairs added cargoes of slaves to ordinary staples they encountered the statute prohibiting such traffic after 1808. Reports of the plundering of American vessels and of conflicts with revenue officials justified the national government in denouncing the interlopers as pirates, and compelled the employment of the army and navy for the suppression of their militant and predatory colonies, whether these lay within or without the recognized boundaries of the Union.

BARATARIA.

The first establishment to be broken up occupied the islands at the entrance of Barataria Bay in Louisiana. The inhabitants of the territory had lived under the government of Spain long enough to acquire the habit of dealing in smuggled goods, and slave-trading had been one of the foundations of the French colony. The facilities offered at Barataria were highly acceptable; and Governor Claiborne had little support in his campaign of repression. He could count on the loyalty of the officers of the naval station, though the first commander of the American troops had been a pensioner of Spain, and the district-attorney was too ready to defend the so-called privateers. When Commodore Porter took command of the station in 1807 he found the river open to French privateers. Acting on his own responsibility, he seized three of these by a boat expedition, and had them condemned in spite of local feeling. Prize-money was allowed, but the commodore did not find it easy to collect the reward of $60,000 which the captain-general of Cuba was said to have offered for the seizure of one of the vessels. Commodore Patterson, who commanded the flotilla and the station during the

British invasion, was as ready to act in the governor's campaign against the corsairs as in General Jackson's defense of New Orleans.

The leader of the pirates of Barataria was the notorious Jean Lafitte. History has no record of the beginning of his career, and his end also remains obscure. For one decade, however, he and his brother Pierre were men of note in the political as well as the financial affairs of Louisiana. It is said that Jean Lafitte had served in a British frigate, and this is not so unlikely as it sounds—particularly when it is added that the Frenchman deserted to become a privateer. Some of the islands of the Gulf were haunted by French rovers in 1810; and the boats of a British cruiser were beaten off at Cat Island in June, 1813. This may be taken as evidence that the British did not favor the corsairs as a means of diminishing the revenue of the United States, though that charge was current. The traffic in prize goods came to be concentrated at Grande Terre, where the Barataria Pass was closed by a bar over which only nine feet could be carried. To the northward of the bay stretched inland channels by which canoes could reach New Orleans in less time than was required to ascend from the mouth of the Mississippi; and this bayou navigation was in constant use. Regular auctions were held at the island when cargoes were brought in; and the Lafittes or their agents took orders for prize goods among the merchants of New Orleans.

The situation implied the complicity of minor officials; but the governor was always zealous against "the brigands who infest our coast." In March, 1813, Claiborne proclaimed his purpose of suppressing a combination of banditti of different nations which had armed vessels "for the avowed purpose of cruising on the high sea and committing depredations and piracies on the vessels of nations at peace with the United States, and carrying on an illicit trade." Unless the rovers were deprived of their "ill-gotten treasure," Louisiana would be forever dishonored. A few months later he declared that the smugglers were "setting the government at defiance in broad daylight" by running in contraband goods. When some of these had been captured they had been retaken "by a party of armed men under the orders of one John Lafitte"; and a warrant for his arrest remained unexecuted. A custom-house inspector who ventured to Barataria in search of

a cargo of slaves was killed in fight, and twelve of his posse were held as prisoners.

Governor Claiborne then offered a reward of $500 for the arrest of the principal offender; and Lafitte replied by promising $15,000 for the delivery of the governor's head. Claiborne resolved to recruit troops for attacking Barataria; but his appeal to the legislature failed to procure a grant of funds, though he urged that the corsairs had destroyed the trade between Vera Cruz and New Orleans. Legal process was of little effect: both the Lafittes were indicted for violating the revenue and neutrality laws—it was hopeless to think of convicting them of piracy; and Pierre was actually arrested on one of his visits to New Orleans. The slave-trade had not yet been assimilated with piracy; but the report that the Lafittes—who seem to have been brokers for the corsairs rather than active privateers—were about to smuggle in 415 negroes, taken in a Spanish prize and valued at $170 per head, showed the magnitude of their offenses. Yet it was almost hopeless to send such cases before a jury; and the defection of the district-attorney was also a hindrance to the course of justice. He resigned to assist Edward Livingston in defending the outlaws, tempted, doubtless, by a fee of $20,000 which he went to Barataria to collect; and he shot his successor in a duel for venturing to condemn his unprofessional conduct. It was not easy to hold any of the clan in prison; but Pierre Lafitte was a captive for several months in 1814; and this may account for the patriotic spirit manifested by his brother when urged to make war on the Americans.

On September 2, 1814, a brig of the British navy anchored off Barataria, and a curious message from the commanding officers of the naval and military force which had invaded Florida was delivered by Captain Lockyer, R. N. Colonel Nicholls invited the commandant of Barataria to enter the British service with the rank of captain, to cease all hostilities against Spain and other allies of Great Britain, and to place his vessels under the orders of British naval officers, promising a guarantee of his property and the protection of his person. The truculent colonel added that he meant to "cut out some other work for the Americans than oppressing the inhabitants of Louisiana," who were invited to "assist in liberating from a faithless and imbecile government your paternal soil" by helping Great Britain to attack the only

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MESSAGE SIGNALLING IN THE FLEET.

By Lieut.-Commander Richard Drace White,
Late Fleet Signal Officer, Atlantic Fleet.

The question of signalling sometimes reminds me of Mark Twain's remark about the weather. He said that people were always talking about it but nobody ever seemed to do anything about it.

People *are* always talking about signalling. I do not know of any other branch of the fleet's work that is so extensively and freely discussed. I do not know of any other fleet topic that arouses such sympathetic interest—in talk. Nor is the talk insincere. Many officers are thinking hard on the subject and are willing to go to great lengths to help signalling along. And as for doing things, the object of this paper is to show that Mark Twain's remark is not entirely apropos.

However, the road to successful fleet signalling is not altogether strewn with roses. There are some boulders. For example, it is one thing for a division officer to tell you what ought to be in the signal line, and quite another for him to give up his prize loader to the signal bridge; it is one thing to teach a sailor to punch holes with a dotter in a grossly enlarged slow-moving bull's eye, and quite another to get this same horny handed sailor to saying his prayers in semaphore; it is one thing to bring an offender at gun drill to a realizing sense of his error if he slows up a load and quite another to fix up a signal-man some two miles down the line who mangles an innocent sounding message from the commander-in-chief and causes a great deal of trouble thereby.

That efficient signalling is essential to the fleet's efficiency, no one who has been in the fleet can doubt. Much of the administration that would otherwise have to be done by letters and guard mail may be done quite as thoroughly and with greatly increased

bestowed upon "these gentlemen" for "the gallantry with which they have redeemed the pledge they gave at the opening of the campaign to defend their country." The brothers Lafitte were expressly commended in this order of January 21; "and the General promises that the government shall be duly apprised of their fidelity." Nothing could be refused to the defenders of New Orleans, and the President complied with Jackson's covenant by issuing a general pardon for the men of Barataria. Jean Lafitte is said to have gone to Washington and to have spent most of his wealth, probably in opposing the claim of Commodore Patterson and his squadron for the proceeds of their capture at Barataria. It is to be hoped that the officers and men of the navy got some reward for the Barataria expedition, since their fortunes had been hard between that event and the day when they fought in the batteries alongside the rovers whom they had regarded as pirates and "hellish banditti" a few months ago. The only resistance which the British advance encountered before landing within six miles of New Orleans was that offered by the Jeffersonian gunboats, which were captured in Lake Borgne, and the *Carolina*, which was burned by hot shot in the Mississippi River.

Lafitte and his comrades could hardly venture to renew operations while a British fleet dominated the gulf; and few ports were open to privateers sailing under the Colombian flag in 1815. Cartagena had been recovered by Spain, and the Mexican insurgents had no harbor on the coast of the Gulf. They had even lost Acapulco; and their corsairs had to be manned and armed in neutral ports. Even the black king of Hayti warned all marauders away from his coasts; he would hang all pirates without fail, "let them call themselves what they will, Cartagenians, Englishmen, Frenchmen, or Spaniards." The cessation of war on both sides of the Atlantic added Americans to the category denounced by King Henry; such adventurers as Lafitte could not be debarred from practising their profession; and new squadrons of corsairs were soon seeking markets and harbors of refuge adjacent to the shores of the United States.

GALVESTON.

Though this establishment was a virtual revival of the Baratarian enterprise, the Lafittes held no military command in Texas during the first year of its notoriety, preferring to act as agents

for the sale of slaves and other spoil in New Orleans. The commandant at Galveston was known throughout the West Indies as Commodore Aury, though it was never clear whether his authority for any particular capture was derived from Mexico or Colombia. This rover is said to have been a Parisian, who, after serving in the squadron under the command of Jerome Bonaparte which the British forces blockaded until its organization was lost, had joined the insurgents of Cartagena either as a naval captain or privateer. He had previously served under a commission from Victor Hugues, the Jacobin who held Guadeloupe for Napoleon until 1810. He was able to bring two well-armed cruisers into the Colombian service; and he is said to have preferred to attack Spanish men-of-war instead of pursuing his regular trade as a commerce-destroyer. He may have had political aims which were not to be reconciled with those of Bolivar; and after two or three years' service he withdrew from the Colombian navy to ally himself with the rovers of the Gulf of Mexico.

The Mexican leaders had sent an envoy to the United States in 1816; but Herrera got no farther than New Orleans, and thus never acquired diplomatic standing. In fact he reverted to his allegiance to Ferdinand VII in 1818—before the privateering colonies founded under his commission had ceased their activity. He was persuaded to visit Galveston and to appoint Aury civil and military governor of Texas; and an admiralty court was installed to deal with prizes taken by the corsairs in the name of the Mexican republic. The collector of customs at New Orleans reported that the negroes whom Aury had brought from Hayti in his schooners had been reinforced before 1817 by many French and Italian mariners who had been "hanging loose upon society in and about New Orleans ever since the breaking up of the establishment at Barataria." Pardon had not cured these vagabonds of their inclination for plunder; they seemed to regard the government's indulgence "almost as an encouragement to the renewal of their offenses." For the neutrality of Louisiana they cared nothing: their system of plunder drew all its resources from New Orleans, where they had been allowed to "enter in distress, augment their force, and renew their crews." The Lafittes were named as principal supporters of the Galveston trade and owners of several privateers; but other citizens were said to be equally guilty in both particulars.

The collector was able to name six vessels which cruised under Aury's commissions, and to enumerate their prizes during the summer of 1817. Slavers were the most profitable captures, since negroes could be sold for a dollar a pound, or about $140 per head. No less than 650 slaves are said to have been in stock at one time, though having found a cargo of 300 infected with a contagious fever, the pirates cut the ship's cable and set her adrift in the Gulf.

Aury may have tired of consuming the proceeds of his prizes and employing his ships in the service of the Mexican revolution. At any rate, after a short cruise in support of General Mina, the "student Mina" of the Peninsular War, and a brief occupation of Matagorda, he determined to abandon his Texan dominions; and before the summer of 1817 was over his squadron of 13 vessels, corsairs and prizes, sailed for the east coast of Florida. The huts at Galveston had been burned and the mud fort dismantled when Aury removed to Matagorda; but the island remained a rendezvous for the pirates for the next three years.

Jean Lafitte, duly equipped with a Mexican commission, took the place of Aury; and by the end of 1817 no less than a thousand freebooters had rallied under his flag. He built a red house on the ruins of Aury's post, entertained lavishly, wore a green uniform, and fought the Indians of Texas when they attempted retaliation for the buccaneering practice of carrying squaws to the island. Those merchants of New Orleans who traded with Mexican ports sent a petition to Commodore Patterson asking convoy for their shipping: cupidity had rallied the freebooters of the gulf and their vessels under the flags of Buenos Ayres, Venezuela, and Mexico, who "pretending to have commissions from the constituted authorities there to cruise against their enemies, but manned with renegado crews of all nations, have lately commenced the plundering of the vessels of your memorialists, sailing under the flag of the United States on lawful voyages, and rob them of whatever specie they find on board." This petition doubtless went to Washington along with the collector's reports, and the new administration found itself compelled to act against the piratical interlopers.

President Monroe's first annual message declared an intention of suppressing the colonies of adventure without much regard for the territorial limits claimed by Spain; and he intimated that Galveston might be regarded as belonging to Louisiana, a proposition

which was not decided in that generation. A committee of Congress considered that part of the message and described the community at Galveston as an association for plundering on the high seas. Spanish property was the objective, but vessels of any nationality which carried specie or other goods of great value were also liable to pillage. The Mexican flag was used, though the connection was doubtful; the presumption of any authority for such an establishment was "repelled as well by its piratical character as by its itinerant nature." John Quincy Adams, the Secretary of State, discussed the situation with his usual austerity: writing on December 29, 1817, he referred to "that buccaneering and piratical spirit which has lately appeared among the South Americans, not of their own growth, but I am sorry to say, from the contamination of their intercourse with us. Their privateers have been for the most part fitted out and officered in our ports and manned from the sweepings of our streets." Naturally he concludes that the President could not delay action against their bases of operations.

The Spanish minister at Washington noted with alarm the President's announcement to the effect that, as Galveston fell within the limits of Louisiana and had been occupied by vagabonds who commit piracy and injure the trade of the United States, he has taken measures to correct these abuses. But, Don Luis de Onis protested, Galveston had never belonged to Louisiana, and its evacuation by the freebooters had been brought about by the royal army which had captured Matagorda and driven them away. Foreign intervention was inacceptable, though Spain's losses by the pirates had been far greater than those of the United States. Galveston had been made a magazine for goods taken from Spaniards and these had been purchased by American merchants for shipment to New Orleans or other ports of the United States.

Whether Monroe and Adams were restrained by the Spanish remonstrance during the negotiations for the purchase of Florida or discouraged by the lawless habits of the Louisianians does not appear; but Lafitte and his company had three prosperous years before Galveston had to be evacuated. In August, 1817, there were a dozen privateers in the Mississippi River, half of them using the Mexican flag under Aury's commission, and the rest that of Colombia under warrants from Bolivar. The Lafittes dealt with all of these, making this illicit trade their only occupation, threatening officials, and setting the laws at defiance. An

eye-witness of their doings at Galveston testified that their sole object was "to capture Spanish property, under what they called the Mexican flag, but without any idea of aiding the revolution of Mexico or that of any of the Spanish revolted colonies." In fact, the government of Galveston "had no connection with that of any other nation, state or people." Yet some forms of law were observed: there was an admiralty court to condemn prizes, and a gallows for pirates who were refractory to Lafitte's discipline.

Thus when the U. S. Schooner *Lynx* approached the bar on November 8, 1819, her commander saw "a gibbet on the point of Galveston with a man hanging"; and he was informed that the victim was one Brown who had robbed an American vessel on the coast of Texas and had been pursued by the *Lynx*. In the version printed in various journals, Lafitte's first letter appears to have required Lieutenant Madison to explain "the reason for your lying off this port without communicating your intentions," and warned him against trying to enter in a hostile manner. Lafitte added that his disposal of Brown proved that he was no abettor of piracy but a governor who respected the law of nations. Madison wrote to the papers—men of his profession had that unfortunate habit in that generation—to say that Lafitte had written in a different tenor; but there is no doubt that he replied by urging Lafitte to continue the good work by arresting other pirates whose names were set forth, and closed with thanks for a courteous invitation to visit Galveston. That privilege fell to Lieutenant McIntosh, who testified that he had enjoyed "most friendly, generous, and hospitable" treatment during a three days' visit at Lafitte's headquarters—where there was doubtless an abundance of the materials for conviviality, though it might not be reckoned civil to inquire how they were purveyed.

The visit of the *Lynx* must have alarmed the confederates at Galveston; and Pierre Lafitte filed on January 3, 1820, an offer "to clear Galveston and disband its inhabitants," with a pledge from both brothers that it should never again become a rendezvous for persons cruising under their authority. This proposal recognized the jurisdiction of the United States as extending to the Rio Grande; and its ostensible object was to rescue the name of Lafitte from the contempt due to its association with "the criminal undertakings of a gang of pirates of all nations," whose "depredations and atrocities" were committed within American territory. The letter was addressed to the commandant of the naval

station at New Orleans, who was told that all that he had to do to restore confidence among those engaged in foreign trade from New Orleans and rid the gulf of "cruisers obnoxious to the government" was to issue the necessary permit for the departure of Lafitte's followers. A month later Commodore Patterson authorized the occupants of Galveston to "depart therefrom with their vessels, arms, goods, and furniture, and whatsoever else may to them belong"—all their plunder, would have been a briefer formula—to such places as they might select outside the jurisdiction of the United States; and the commanders of vessels attached to the station were instructed to respect this permit, provided the corsairs respected the shipping of all allies of the United States during their passage.

Patterson further specified that the defenses and buildings of Galveston should be razed to the ground, and "every means be removed from thence which has hitherto rendered it the retreat and security of pirates" and other disturbers of traffic. The *Lynx* visited Galveston on June 19; and Lieutenant Madison reported that Lafitte had evacuated the island some weeks before, burning all his houses according to contract. A rich prize had subsequently been brought in, abandoned, and run ashore; and some of her goods were buried among the sand-hills. This correspondence and its sequel seem to have been unknown to the best historians of Texas and Louisiana, though preserved in the records of the navy.

Lafitte had to take to the sea at last; and he was somewhat vaguely reported as a leader among the pirates who were fighting and plundering on the coast of Cuba in 1822. Two years earlier his status as a pirate was ascertained by the conviction of three of his men for piracy in robbing a Spanish vessel in the Gulf. This verdict of the federal district court at New Orleans was rendered ineffective by pardons from the President; and men thus restored to their friends were robbing American vessels in 1821. One of Lafitte's vessels was surrendered at New Orleans in 1820, the crew having mutinied and marooned their officers. In this year also the district court of the United States at Norfolk restored to the Spanish consul certain bales of cochineal which had been taken by an American captain in a cruiser hailing from Buenos Ayres. The court accepted the plea that no American citizen could lawfully take prizes from the Spaniards, whether he cruised as a privateer or an officer in the Argentine Navy, basing this rule upon

our treaty with Spain. The decision was affirmed by the Supreme Court, though the doctrine was less clearly stated in the final decision. No obligation to punish the perpetrators of such seizures as pirates was established by the treaty; but had its provisions been applied to prize-goods brought to New Orleans by Lafitte's corsairs his profits would have been scanty.

It has been related that Jean Lafitte died in Yucatan in 1826, just as piracy was going out of fashion; but his end remains as obscure as his origin. In spite of his care in procuring commissions against the Spaniards and his care to avoid conflicts with the United States Navy, Lafitte must be rated as a pirate rather than a filibuster, since he robbed only for personal gain. He had little care for the public welfare of any of the countries he adopted, and, being a broker rather than a corsair throughout his career, he did nothing to make buccaneering romantic. Whatever he was, his record offers little enough for the purveyor of retrospective romance or melodrama. Yet he must take his chance with his betters in the hands of those who write for the market.

AMELIA ISLAND.

The predatory stations along the gulf coast had been located with reference to the market afforded by New Orleans and the plantations on the banks of the Mississippi. For traffic with the frontier towns of Georgia a station in eastern Florida was requisite, and such a colony of adventure might command the navigation of the Bahama Channel, the outlet of commerce by the flotas and galleons ever since the set of the Gulf Stream had been discovered in the sixteenth century; and the Huguenot strategists who planted a colony on the banks of the St. John had intended to reap a rich harvest along that track. Pedro Memendez put an end to that undertaking by the massacre of Jean Ribaut and his men in 1565. Had not the British occupation of Florida after the Seven Years' War terminated in 1783 the commerce of the West Indies and the gulf would have been subject to arbitrary control. The Spanish domination was a matter of less significance to the United States; but it proved inconvenient to have the Florida coast open to the establishment of roving colonies.

The first interloper who demonstrated the weakness of the Spanish garrisons in 1817 was Sir Gregor MacGregor. This

chief of a clan whose very name had been proscribed in the days of Rob Roy, was the typical adventurer of the restless generation which saw the close of the Napoleonic wars. He had served in the Peninsular War in the British or Portuguese army before he went to the Spanish Main with Miranda and allied himself with Bolivar; and his rank of general in the Colombian service was won by hard fighting. But the patriots persisted in regarding him as a foreigner in spite of his record and his marriage with a lady of the Liberator's kindred; and MacGregor resolved to start a detached revolution to make Florida the eighth republic of Spanish America. He found certain Spanish-American commissioners in Philadelphia, and they granted some sort of a warrant for his enterprise. His troops were recruited in Charleston and Savannah, with the understanding that Florida was to be ceded to the United States at a convenient season. This force was sufficient to procure the surrender of Fernandina by the Spanish commander; and MacGregor proclaimed his intention of hoisting the green cross of Florida—his newly devised ensign—on "the proud walls of St. Augustine"; but that town was held by a resolute Spanish governor. Authority for blockading the coast was claimed "under the commission of the supreme governments of Mexico" and other republics; and the privateers were described as a naval force adequate to its maintenance. Grants of land in the territory to be conquered were also offered to those ready to hazard money or life in this enterprise. Altogether, MacGregor had nearly a thousand men when his two schooners and his flotilla sailed from Darien, Georgia; and Amelia Island was in his possession on July 9, 1817. The event had more notoriety than its intrinsic importance justified; and random adventurers of all nations were soon heading for Fernandina.

The first reinforcement came in a schooner owned by Ruggles Hubbard, a politician who had been made sheriff of New York by a corrupt bargain; and his resources were sufficient to compel MacGregor to admit him to a share in the government. A Colonel Irvin of Vermont was made treasurer of the island; and bills based upon expectations of plunder were put in circulation. The government was prepared to collect a tariff on imported goods, as well to levy admiralty dues on the proceeds of privateering. There was force enough to beat off a Spanish attack on September 8; but the financial situation was desperate.

MacGregor resolved to cross to New Providence to seek money and supplies; and Hubbard lent him a schooner for the voyage. The American contingent thus held control when the arrival of Aury and his squadron from Galveston transformed the situation. MacGregor tried to bargain with the Frenchman; but Aury would take no lower place than that of commander-in-chief, though Hubbard was allowed to call himself civil governor for a season. The green cross of Florida was hauled down, as Aury declared that MacGregor never had any commission whatever for his conquest, and the flag of Mexico was displayed, as at Galveston. This revolution was but the beginning of Governor Hubbard's tribulations: and he must have regretted the difference between politics in New York and his adventure in Florida. Aury left no authority in the hands of the civil magistrate, and all opposition was silenced by the landing of a guard of 130 brigand negroes, "a set of desperate bloody dogs"—probably Haytians hardened to revolutions. Hubbard tried to intrigue for the cession of Florida to the United States, offering everybody promotion and Aury a commodore's commission in the American Navy. The filibuster refused and paraded his black troops to force Hubbard to give up his authority; and thus the deposed leader was driven "to an act of intemperance which soon terminated his existence," or, as Aury related, "died under the agonies of his crimes," when his plots were detected.

This left the American party without a leader, Colonel Irvin, though he had been a member of Congress, proving incapable. The English-speaking element was soon strengthened by the arrival of some thirty officers, many of them Scotch or Irish, who had served in the wars with France and had been engaged to serve Venezuela with increased rank and pay. Upon arriving at St. Thomas they were discouraged from proceeding to South America, and rumors of MacGregor's conquest tempted them to sail for Florida. Aury was not inclined to welcome so many officers, and he tried to send most of them to Venezuela to seek employment. He had one restless Englishman brought before a court-martial made up of privateering captains for trial "under the naval code of the United States." Counsel for the accused found his objections overruled, and he ventured to warn the members of the court that he would "forward their names to the different governments of which they are still subjects, and . . . draw upon them the punishment which their contempt of justice

deserved." Naturally, the prisoner was found guilty—and banished from the republic, which his defender also had to quit. Aury's faction was strengthened by the arrival of a party of Frenchmen, veterans of the *Grande Armeé* for the most part, who had been recruited on the same terms as the British contingent. They had sailed from Charleston for Amelia Island as soon as they heard that their compatriot had won the command; and Commandant Persat, a truculent survivor of the Napoleonic wars, has told how he organized the French troops as Aury's chief-of-staff. The crisis arrived on November 16, when Persat drove the Americans from their block-house and captured their two guns, panic preventing any effusion of blood.

Aury did not long retain the supremacy he had won. Florida began to be the subject of international discussions; and President Monroe coupled Amelia Island with Galveston as establishments which violated our laws and threatened our commerce—and therefore had to be suppressed. There were precedents for the seizure of Amelia Island: it had been the rendezvous of smugglers after the renewal of the Jeffersonian embargo or non-intercourse act in 1809; and its occupation had been ordered as a means of protecting the revenue. Congress had enacted in 1811 that the President might seize any part of the Floridas to prevent foreign invasion; and Pensacola and other places had been held during the war of 1812 by American as well as by British forces, though the law of 1811 was kept secret until after it had been determined to expel Aury from the borders.

An expedition was organized under the command of Captain Henley, U. S. N., and Colonel Bankhead, U. S. A., and the island was summoned to surrender on December 22, 1817. With troops enough to garrison the island, backed by the guns of two sloops-of-war, there could be no doubt of the result. Aury declared that he held the conquered island with all the rights that could pertain to any government: and that he was not aware that the United States were at war with any of the republics which had revolted from Spanish authority; "Are you acting in the name of the King of Spain or his allies? We cannot admit that you have already arrived at such a point of degradation." But his conclusion was that if the officers persisted, "we respect and esteem too highly the people of the United States to proceed to extremities." The island therefore capitulated on the 23d. The American commodore's anxieties were not yet over, however: he had given

the Frenchman a month to collect his archives; and at the end of a week he reported, "I am fearful that Aury and his followers will give us much trouble before they quit the island. I am sorry to add that the Americans appear to be much worse than any other." Elsewhere the followers of Hubbard are described as rabble from the streets, by no means fit to contend with Aury's negro brigands, whose color caused so much apprehension throughout the southern states.

Aury was arrested in Charleston in March, 1818, for the capture of a Spanish brig on the high seas; but the district court declined to assume jurisdiction over prize cases occurring *flagrante bello*. That Aury was not an American citizen was indicated by this decision as well as by the fact that he was then trying to negotiate with the government by sending a Peruvian diplomatic agent to Washington. Don Vicente Pazos represented Aury's command at Amelia Island as a regular government, though it had only lasted twenty days after the overthrow of Hubbard; and he gave an interesting abstract of his principal's service in promoting the independence of Spanish-America. But he found the case closed before his appearance in Washington.

The President had sent a special message to Congress on January 14, 1818, reporting the suppression of the establishment at Fernandina and arguing the case against the adventurers with some vigor. They had dealt in everything contraband, and their conduct in regard to slaves had been "of the most odious character," causing injury and annoyance to the United States—that is, as stated in an earlier message, the island had been made "a channel for the introduction of slaves from Africa, an asylum for fugitive slaves, and a port for smuggling of every kind." The adventurers were not natives of Florida or, for the most part, of any of the countries they had set out to revolutionize; and their assumption of sovereignty threatened encroachment on territory belonging to Louisiana, as well as the conquest of Spanish possessions. Monroe's arguments were expanded in the report of a committee of Congress, as if in anticipation of protests from all concerned; and much was said of "the timely interposition of the naval force under direction of the executive" to break up an itinerant combination of foreign adventurers. The forms of free government had been "prostituted by a horde of foreign freebooters for purposes of plunder," and it was necessary to deprive them of their place of refuge.

The President had pointed out that Spain would be responsible for the mischiefs done by these interlopers were it not manifest that, although committed through her territory, she was utterly unable to prevent them; and he had denied any intention of making conquests of Spanish possessions—or of injuring the cause of the revolted colonies. But before the Spanish minister had time to file the inevitable protest General Jackson had invaded Florida in pursuit of Indians and those whom he called "land pirates," meaning certain Englishmen who, in pursuance of MacGregor's projects or others of the same type, were intriguing among the Indians; and Spanish sovereignty had hardly survived the shock of his operations. Nevertheless, Onis insisted in July, 1818, that, as MacGregor's expedition had been recruited and armed at Charleston and Savannah, there was "no just ground for converting into an act of hostility or detriment to Spain the evils resulting from the toleration of such armaments in the states for the invasion and plunder of the possessions of a friendly power." John Quincy Adams, who found arguments to justify even Jackson's arbitrary conduct, told the minister that Spain could hardly expect the United States to defend her territories or rescue them from adventurers for her exclusive advantage. It was still urged in behalf of Spain that the United States ought to prevent all hostile armaments in her ports against the commerce and possessions of Spain, either by Americans or adventurers of any other nation, or by the rebels of Spanish America; and that all pirates found in American waters should be arrested and their spoil restored to its Spanish owners. The treaty for the cession of Florida was signed by Adams as Secretary of State and Onis as Minister of Ferdinand VII on February 22, 1819, thus disposing of the affair of Amelia Island. Other controversies were elimination in the ninth article, the United States renouncing "all claims on account of prizes made by French privateers, and condemned by French consuls, within the territories and jurisdiction of Spain"; and against these were set off "all injuries caused by the expedition of Miranda, which was fitted out and equipped at New York," as well as certain unlawful seizures at sea or in American ports, thus condoning filibustering in retrospect.

MacGregor was expected to invade Florida in 1818 to found a colony of adventure at Tampa Bay; but he failed to find the resources for that enterprise. In December he sailed for the Caribbean at the head of a new expedition. Making Hayti his base

of operations, he occupied the islands of St. Andrews and Providence, which had been formidable rivals of the settlement of Massachusetts Bay about 1640, when they were colonies of adventure under the control of the leaders of the Puritan party in England. To these isles MacGregor invited privateers of all nations; and Commodore Aury soon brought his black troops to the rendezvous; and Persat relates he died at Old Providence about 1819—though another story has it that he dwelt in Havana until 1845. His great wealth was divided among his French followers—millions of francs which he might have taken home to Paris had he not resolved, Persat reports, to found a republic of which he should be the head. Aury was, however, less addicted to fantastic adventure than his colleague. MacGregor took Porto Bello in April, 1819, but his followers fell sick or deserted, after trading cartridges for rum; the place was soon recaptured; and MacGregor only escaped by swimming off to his flagship. He then got a concession for some fifty millions of acres on the Mosquito Coast; and described himself as "His Highness Gregor, Cacique of Poyas," when he went home to recruit colonists and raise money. The Highlanders whom he carried to Nicaragua died miserably; and the borrowed funds were never repaid. In his old age, MacGregor had occasion to recall that he was after all one of Bolivar's lieutenants and a general in the Colombian army; and he got his rank recognized at Bogotá. He did not long enjoy his retired pay, but died in obscurity some twenty years after his last venture as a promoter of privateering.

II. The Later Piracies of the Antilles.

When the corsairs lost their last refuge on the gulf coast the merchants who traded to the West Indies may have counted upon a season of comparative security. Although the revolt of Spanish America still gave Spain and half a dozen republics full belligerent rights there were many openings for legitimate traffic on the main and among the islands. Five years after the end of the great war in Europe and the small contest between Great Britain and the United States it might have been anticipated that the seas would have been policed, and that most of the privateers would have found other employment. But Spain could do little to protect her own commerce, since her navy had not recovered from defeat, and many officers had been granted leave to earn a living

by fishing. The purchase of a squadron from Russia proved a bad bargain, and no effective force could be sent to the West Indies. Yet the Spanish government proclaimed a paper blockade of the coasts of the main; and in default of regular cruisers, privateer coast-guards were armed in the Antilles and sent out to intercept all vessels suspected of breaking the blockade. Irresponsible captains abused the right of search and strained the doctrine of continuous voyages and contraband to make captures. The corsairs commissioned in the name of the new republics—many of them by exiles or pretenders to authority—were so frequently commanded by American seamen that vessels under the flag of the United States were generally respected, even by the most unscrupulous of the rovers, men hardened by privateering or the slave trade.

The two classes of corsairs for which Spain might be called to account, were, according to an official despatch by John Quincy Adams in 1823, "privateers . . . distinguishable from pirates only by commissions of the most equivocal character who committed outrages which no commission could divest of their piratical character and piratical vessels belonging to Cuba which went to sea without pretence or color of commission." The latter were disavowed as pirates by local authorities; but they were hardly distinguishable from the licensed privateers, especially when they could purchase connivance by sharing their spoil with merchants or magistrates. Americans were generally detested in the islands because their government had allowed so many of them to serve or supply the revolutionist of Mexico and the main; and successive revolutions in Spain prevented the adoption of any consistent policy for maintaining diplomatic or commercial relations with the United States.

THE COAST OF CUBA.

By the end of 1819 the mercantile community of the United States had to protest against the conditions which had led to the plundering of 44 American vessels in one year. The evil was "ascribed to defects in the law of nations or to the laws not being enforced" by the president of an insurance company in Boston, where Webster and Channing were then supporting an appeal for the suppression of all forms of privateering, since men were thus led "to shed blood for no other ends than private gain." The corsairs licensed in South America, some of whom had four com-

missions from different rulers and thus escaped all responsibility, took prizes on our Atlantic coast with little regard for their nationality. The slave-traders proscribed by previous statutes were in 1819 made liable to the penalty of piracy, and the definition of that crime was otherwise extended by Congress and the Supreme Court, which ruled in 1820, with reference to a privateer commissioned by Aury, that no person sailing from a port of the United States under commission from a belligerent is protected from punishment for any offense committed against vessels of the United States, and that the offender had committed piracy. The Admiralty of Great Britain had already instructed captains cruising in the West Indies concerning "divers piratical acts and outrages against the vessels and goods of his majesty's subjects" under color of hostilities between the King of Spain and the revolted provinces, and had ordered that offenders in this kind should be sent in for trial wherever there was a competent court in any British possession.

The Pacific was not free from these evils. Sir Thomas Hardy and Captain Ridgeley of the U. S. S. *Constellation* had occasion to act against piratical establishments at the islands of Santa Maria and Juan Fernandez on the Chilean coast in 1821. But the Cuban pirates were of more pressing importance, and the public heard with relief that the U. S. S. *Macedonian,* Captain Biddle, with a contingent of 200 marines was to sail on a "pirate-huntng" expedition, "to sweep the land as well as the sea of the priates of Cuba." Something was accomplished during the summer; but Biddle was led to believe that the captain-general meant to exclude our cruisers from the Cuban ports of entry—a prohibition which does not appear to have been intended. This squadron sailed in March, 1822, a few days before a committee of Congress had filed a report upon the spread of piracy, "attracting to it the idle, vicious, and desperate of all nations, more particularly those engaged in the slave-trade from which the vigilance of American cruisers has driven them; and that if not winked at by the authorities in the island of Cuba, they are in no respect restrained by their interference." Congress did not act until the next session; but early in 1823 the President was authorized to build or purchase vessels at a cost of $160,000, to be employed for repressing piracy, though one member objected to the purchase of steamers and schooners because they would not be permanently useful in

the service. But the reports from Cuba were too alarming to admit of further delays.

While committees were discussing measures of protection the navy had to act. Lieutenant Lawrence Kearney in the *Enterprise* had already broken up a pirate establishment at Cape San Antonio by sending in five boats to cut out three schooners and one sloop belonging to the pirates and recover three prizes, two American and one English. The brigands all fled without fighting; in fact the *Enterprise* took 17 sail within a few months without killing a single pirate. Among the papers captured evidence was found in regard to the seizure of the *Exertion* and *Contitution* of Boston by a gang of pirates which included a score of Lafitte's men recently pardoned. These vessels were taken in December, 1821, and the crew of the *Exertion* was marooned on a barren cay. Six men perished in attempting to seek relief in a boat built out of sugar boxes found on the beach; but the captain was rescued. Among the incidents of pirate-hunting may be noted the rescue of a sloop found adrift "with only a dog on board and blood on her decks," a Colombian privateer in the hands of mutineers, and a British brig, the captain and mate of which had been hanged.

The domestic manners of the pirates appear in the record of the plundering of the American brig *Aurilla* on Sal Cay Bank in May, 1822. Upon sighting a schooner the American sent all her negro passengers on deck "to frighten them off if they were pirates," but after a shot had made her heave to the *Aurilla's* sails were riddled—and her deck cleared, no doubt—by a few rounds of grape. Boarders drove all hands below, and the prize was anchored. Next morning an inquiry began as to whether there was any specie on board; the pirates were polite at first, but they soon cleared the deck and prepared for torture. Each man called up expected death, as he heard a pistol shot terminating the examination of his luckless predecessor. Each had to run the gauntlet from cabin to windlass under blows from the pistols or cutlasses of 15 or 20 monsters, all of whom appeared to be Spanish. Then the victim was told to sit down to die, and a shot was fired. The murder was not completed, however, and the supercargo was made to endure two rounds of torture. The brig *Hiram* of Newport anchored on the bank and was also plundered. The negro women of the *Aurilla's* cargo were maltreated in public, and the captors showed that they knew all the tricks of their trade. Yet they

were not invincible, as the brig *Patriot* of New York showed in September, 1822, by beating off a pirate schooner manned by 40 or 50 ruffians, many of whom fell. The American captain, whose wife was on board, and his second mate were killed in this action.

The year did not close without brisk engagements between our cruisers and the pirates. Lieutenant Stockton in the U. S. Schooner *Alligator* had rescued several prizes in May and June before he had an encounter with a schooner near Sagua. The 70 pirates on board were said to be under the command of Jean Lafitte; but as they kept inside the shoals the rumor could not be verified by her capture. It was reported early in March that the Spanish governor of Matanzas had broken up piratical stations at Point Icacos and Puerto Escondido, bringing in prisoners from both; but later news showed that the plunder of wrecks and prizes was still carried to Point Icacos. Rumor had it that an American brig had been robbed off the point; and the *Alligator* sailed from Matanzas for a search. On November 9 a schooner was sighted with her deck full of men and Stockton lowered his boats to chase in-shore. When some ten miles had been rowed the schooner rounded to, hoisted the red flag—this signal for battle was as often worn by pirates as the black ensign first adopted as an emblem of mourning and revenge after the execution of Charles I—and opened with round and grape. The boats could only return musketry; but a dash was made to board. The pirate was silenced and deserted by her crew, covered by the fire of a consort. Lieutenant Allen sent a midshipman in the gig to take charge of the prize, and pulled for the second schooner, which now had 100 men at quarters. Within two boats lengths the attack was checked: the cutter sheered off, encumbered by the dead and wounded at the oars; Allen in the launch was hit by two balls; and both boats dropped back to the schooner they had taken. The gallant officer died in four hours, regetting nothing except that he could no longer provide for his mother and sister. The prize was well armed with six and twelve-pounders; and two other vessels were recovered the next day. The governor of Matanzas paid honor to Allen and his comrades, of whom four were dead, by sending an escort to the funeral. He had already shown good will by lending arms and granting a warrant to a plundered American vessel to attack the pirates and recover her own. The *Alligator's* boats had killed 14 of the scoundrels, and many had been wounded.

Congress having sanctioned the equipment of a squadron "for the purpose of repressing piracy," Commodore Porter was appointed to command it and superintend the purchase of vessels. He bought eight schooners of the Baltimore type and also the steam galliot *Sea Gull,* perhaps the first steamer to be used as a flagship; and these were supported by two or three sloops-of-war and by the older schooners already in the service. These were named for marine monsters—a boatswain of forty years ago abounded in reminiscences of the schooner *Shark,* "with a flying berth-deck, all gratings and hatches"; but the newer lot had names ranging from *Fox* to *Ferret;* and there was also a flotilla called after insects. All expectations were disappointed when these light-draft vessels were set to work; the hardest tasks fell to boats cruising along the reefs; and Porter had to ask for frigates to give his men rest and comfort after weeks spent in open boats. Tactically, light guns and small arms were the most effective armament for pirates or their antagonists, as the buccaneers had long since demonstrated; and none of Porter's schooners ever closed with an enemy of equal force.

The commodore's instructions must have caused as much concern as his equipment. Congress had refused authority for the commanders of our public vessels to "destroy pirates and piratical vessels found at sea or in uninhabited places," holding it inconsistent with the laws to punish without trial. The Secretary of the Navy, Benjamin Thompson, doubtless consulted President Monroe before giving Porter his sailing orders: "moderation and forbearance," were duly enjoined before tackling the problem of territorial jurisdiction. It could not be assumed that any nation would countenance piracy; and those sent to suppress it had "a right to the aid of every other power." As belligerents may carry pursuit into neutral territory, "in the case of pirates, the right . . . is more complete," since there could be no neutrals in regard to enemies of the human race. As for the retreat of the banditti into uninhabited parts of the islands, the commodore was told to pursue "only as long as there is reasonable prospect of being able to apprehend them," turning captives over to the local authorities for trial and punishment, or, if prosecution was not promised, holding them subject to the department's order. In port and in settled districts he could act only to aid the local authorities "to seize and bring the offenders to justice," a limitation which

has to be kept in mind in discussing the commodore's subsequent trial by court-martial.

Porter's squadron sailed from the capes of Virginia in February, 1823, and on May 10 he reported from Matanzas that within 43 days from the date of sailing he had examined the north and south coasts of the Greater Antilles, searching coves and cays, and driving the pirates inland, where only Spanish authority could reach them. No captures had been made at sea during this "arduous and fatiguing" cruise; but something had been done for the protection of commerce. The commodore stated his case more emphatically in a letter to the New York *Evening Post* as soon as he had read its number of April 10, which had pointed out that piracy was still "prosecuted with increased and triumphant success every day," and that this compelled doubt as to whether his squadron had been disposed in the most efficient manner. Porter never refused a challenge to take part in a debate in the newspapers; and he replied by relating how he had set about his task of "thoroughly scouring the West Indies"; the *Peacock* had just been brought into the harbor of Matanzas by her captain and sailing-master without the help of other officers, the rest having been left "in the ship's boats in search of pirates among the cays 300 miles to windward." There had been no vessel of the Navy in Cuban waters when he sailed, and his request that the New York papers should keep his movements secret had been made in vain: "It is to the total destitution of protection to our commerce then, and to the information given to the pirates through the press . . . that they were encouraged to make a last effort to obtain all the plunder possible before my arrival." It is hard to conceive that Domingo and Diablito read the *Evening Post*, even when they found it in a prize, and it was soon apparent that piracy was not extirpated in May, 1823. Yet much had been endured and something accomplished before the commodore began to write.

The brig *Pilot* of Norfolk was taken by the notorious Domingo, who had commanded the pirates when Lieutenant Allen was slain; and the prize was sighted early in April, eight days after her capture, by the *Jackall*, commanded by Lieutenant Stribling, U. S. N. After chasing all day between Havana and Matanzas Stribling lowered his boats to take possession, and most of the pirates jumped overboard. Many were killed or drowned, 14 at least, but Domingo and three others swam ashore. The pirate

captain's escape was to be regretted, of course, though Porter credits him with a "singular act of politeness" in forwarding all the letters for the squadron which he found when the *Pilot* was taken; but his Latin gallantry led him to retain the miniature of an officer's wife.

During April also the *Peacock* had gone to the westward as far as Cape San Antonio, Captain Cassin conducting a flotilla through the intricate channels inside the Colorados Reefs. After taking a new 16-oared boat which the pirates had hidden among the mangroves near Bahia Honda Cassin trimmed his vessels by the head and followed the boats which took soundings to find the channel. His vessels often grounded, and sometimes had to be hove through the mud in six feet of water. Not more than 20 miles a day could be covered; but Cassin succeeded where the English had failed; and his task can hardly be appreciated except by those who have cruised inside the Colorados. The voyage was enlivened by the discovery of a deserted village from which the pirates had fled, and their palm-leaf huts were burned to the ground. The same passage was made in 1824 by the *Sea Gull* and a barge which entered at Cape San Antonio and proceeded eastward to meet another flotilla; but they missed taking Diablito, who had sailed from the cape ten days before their arrival.

This rover had escaped from the active pursuit of Lieutenant Watson, U. S. N., in July, 1823, when the boats of the *Mosquito* and *Gallinipper,* manned by only 26 seamen, chased a topsail-schooner and a barge into Seguipa Bay. The schooner anchored with a spring on her cable, and her long nine and two six-pounders opened with grape. The boats dashed in with cheers—"Huzza for Allen!" and that sort of thing—and the pirates jumped overboard; some were killed in the water; but Diablito survived to renew his piracies. It is not always clear whether the failure to take prisoners was due to the facilities of the jungle or to the feeling that, in the words of the late Admiral Porter, the atrocities committed on our merchantmen had "placed the freebooters out of the pale of mercy." Lieutenant Newell in command of the *Ferret* seems to have held similar views when he chased a pirate into a bay east of Matanzas and found that the reef was breaking across the entrance: "I was then compelled to resort to making tacks close in with the reef, giving them long tom with round and grape in hopes to destroy the boats—as to killing any of them,

it was impossible." But their den was broken up by Spanish troops next day.

The south coast of Cuba was no less infested by pirates than the Old Bahama Channel, and Cape Cruz and the Isle of Pines were among their lurking-places. Lieutenant Kearney sent two boats to assail the pirates who had fortified themselves near the cape; and the exhaustion of the senior lieutenant left the expedition under the command of Farragut. The pirates did not stand to the guns they had mounted on a bluff, and their huts were destroyed without loss of life. A woman was seen among the outlaws, but no captures could be effected. Two men so old and decrepit that they were not fit subjects for chastisement were released. Kearney had kept only one officer and men to work the guns in each schooner when he put them aground in six feet of water to support the landing-party. He recommended, in view of his experience at Cape Cruz and Cape San Antonio, that, "the fishermen, as well as the pirates, should be removed from all the capes or other uninhabited parts of Cuba where the proper authorities have no control." Farragut's notes on the affair are somewhat in the Tom Cringle vein, as he had to describe the results of a long tramp through mangrove swamp and chapparal upon the costume of himself and his party.

The Yucatan Channel was by no means a safe trade-route. Pirates were said to inhabit the islands; and Contoy and Isla de Mugeres—which our people called "Mohair Key" in the same temper that transformed Cayo Hueso into Key West—were searched without result. But Lieutenant Gregory of the *Grampus* heard of a pirate establishment at New Malaga near Cape Catoche, where nine prizes had been brought under the shelter of a fort. Spoil was regularly shipped to Havana; and the brigands went out in small boats to intercept merchantmen. The American schooner *Shibboleth* was found at anchor in June, 1823, and boarded by 14 ruffians in a canoe. After killing the anchor-watch the pirates drove the rest of the crew below, spiked down the hatches, and piled logwood upon them. When they finished plundering the ship was set on fire with her head sails hoisted to drive her ashore; but by desperate exertions the crew got on deck and saved their vessel. Among the nine prizes taken in two months was a Guineaman with a hundred slaves and a lot of ivory —for which a market had doubtless been found in Havana.

Gregory could hardly venture inside the reefs to attack this establishment, but the pirates soon had to desert Yucatan.

Porter's first year in the West Indies closed more quietly than it had begun; and the President's message gave the squadron credit for having "almost entirely destroyed the unlicensed pirates of Cuba" prior to December, 1823, adding, however, that the same crime was still committed in adjacent waters "under the abusive use of Spanish commissions," with Porto Rico as a base of operations. The President also referred to foreign efforts for the suppression of piracy; and the story would be incomplete without some notice of the work done by the British naval forces.

The Admiralty had issued orders for the maritime police of the West Indies in 1818; but these seem to have been forgotten in the foreign office by 1822, when Canning, alive to the danger that the United States, in order to prevent further depredations, might seize Cuba as well as Florida, and thus hold "both shores of the channel through which our Jamaica trade must pass," sent warning to Madrid. He contemplated sanctioning reprisals by which the shipping and harbors of the Antilles and the main should be made answerable for the injuries done by those commerce-destroyers they had assisted or sheltered, calling this "a local remedy for a local grievance." The Spanish government, Ferdinand VII then ruling as absolute king, was urged to instruct its own officers to act "in time to prevent a blow being struck in anger."

Just after the new West Indian squadron sailed in December, 1822, Canning learned that the admiral on the station had "already taken upon himself, from the very necessity of circumstances, to do and threaten almost as much without orders as his orders will now prescribe." When a new squadron was sent out in 1823 it was placed under the command of Sir Edward Owen with a commodore's pennant, the admiral being recalled. Porter thought this was done in order that he and the British commander-in-chief might meet on equal terms, and though declining any general plan of cooperative cruising, he testified to the cordial support of the English officers on the station in the campaign against piracy. Sir Edward Owen did not refrain from calling Porter's attention to the fact that the British forces had better fortune in making captures than had fallen to the lot of their rivals and allies, the Americans. This was written with reference to the seizure of

the notorious *Zaragozana*, with her crew of cut-throats, by the cruisers *Tyne* and *Thracian* in April, 1823. The British ships were disguised as merchantmen when the pursuit began; but the pirate was not deceived, and he crowded sail for one of the harbors to the westward of Baracoa. With his broadside trained on the entrance and his musketeers in the thickets he opened fire under the Spanish ensign—which he soon replaced by the black flag to give his men the courage of desperation. After 45 minutes the English boarded, and the pirates sprang overboard. Ten of them were killed; 16 fell into the hands of the Spaniards; and 28 were carried to Jamaica, where they soon paid the penalty of their crimes, dying bravely enough, if Michael Scott can be trusted. The *Zaragozana* had been fitted out in Havana in January, 1823, and allowed to sail as a merchantman—with a crew of 50 men.

Another rover called Pepe had lost his schooner *La Gata* in a similar action with H. B. M. S. *Grecian* in March, 1823. The pirate fought at anchor with his eight guns on one side, the red flag at the fore and skull and crossbones on a white ground at main. The *Grecian* lay aground for 50 minutes, plying round and grape until the pirate blew up. A third of her crew of 90 were killed or wounded, but only five were taken, a flotilla being at hand to rescue them, as well as to take part in the fight. The *Icarus* broke up a pirate colony at the Isle of Pines, where Pepe, who was on the best of terms with the Spanish governor, is said to have been killed; and the same captain visited Bahia Honda in August, 1824, killing many pirates and cutting out two of their vessels and a captured American brig. These were substantial achievements which Porter's captains were striving to emulate.

The commodore had established friendly relations with the captain-general of Cuba as well as with the British commander-in-chief. In May, 1822, Biddle had applied at Havana for leave to pursue pirates on shore, and met with an explicit refusal. A year later Porter understood that his ships were to be excluded from all Cuban harbors; but Captain-General Vives disavowed any such ruling and directed the cooperation of all local authorities with the Americans. In 1824 Porter released a vessel captured by Lieutenant Kennon, whose trial by court-martial was the sequel of the inevitable newspaper quarrel, accepting the captain-general's certificate and testifying to his loyal support of the campaign for the suppression of piracy.

The activities of 1823 were arrested in August by an outbreak of yellow fever at Key West, the new naval station which Porter had founded under the name of Thompson's Island. During the first week in September two lieutenants and two midshipmen died, and the commodore and all his surgeons were prostrated. Such epidemics were frequent in those days; the *Peacock* had lost as many officers and men in 1822 as were stricken at Key West in Porter's time; but the movements of the squadron were hampered: and the department had to inquire whether its new station could be made healthful. A medical board reported that pools of standing water made the air unwholesome and that the "annoyance of mosquitoes and sand-flies" deprived overtasked officers and men of the necessary amount of rest. The remedy was to send invalids north and to have a floating hospital anchored to windward, where the air would be pure and the sick beyond the reach of annoying insects. Doubtless the recommendation was sound, though the theory was still imperfect.

The commodore reported from Baltimore in November that he knew of no pirates afloat or established on shore in the West Indies; all had been taken, burnt, destroyed, or driven ashore to fall into the hands of Spanish troops. He had "searched every nook and corner" of the Cuban coast; and he had found barges the most efficient force, though a frigate was needed to supply crews for the flotilla. This report gave color to the President's message, and the new Secretary of the Navy, Samuel L. Southard, recorded the approbation of the department for the services of the squadron.

Porter sailed for the West Indies in February, 1824, and made the rounds of the station, beginning at St. Thomas and Porto Rico, and hearing of pirates on the Cuban coast. Yellow fever broke out at Key West on May 28, and the commodore wrote that he meant to send most of his vessels north. He and his letter arrived at Washington on the same day, June 24, and the department ordered several vessels to return to the station without delay. Two of the schooners had been left to convoy shipping between Key West and Matanzas; but the press, backed by complaints from merchants and insurance companies, began to indulge in criticism, all of which the commodore indignantly repelled. He pointed out that his efforts had changed the character of piracy, which no longer roamed the sea but took spoil in open boats, and thus became harder to suppress. The pirates could count on

finding merchantmen becalmed at certain hours of every morning, and could retire to their lurking-holes as soon as they had taken plunder. The islands off Yucatan and the channels inside the Colorados Reefs had been diligently searched in April without finding any pirates.

Nevertheless, the brig *Acasta* of Portland was robbed in that month, and her crew were maltreated before their release. In July, however, it was reported that Domingo and Diablito, having formed a league of pirates in Yucatan, had quarreled with their comrades over the distribution of spoil, and that the latter had been blown to pieces by a blunderbuss, Domingo swimming ashore after his arm had been slashed by a cutlass and returning to Havana. An agent of the state department investigated conditions in Havana, and his reports, which the commodore much resented, gave notice of later piracies. A rendezvous at Sal Cay drew in many of the crews of slavers and other Spanish vessels which the Colombian privateers had captured and sent into Matanzas. The captain of one of the rare Spanish men-of-war on the coast had been seen in communication with a notorious pirate, and his explanation that he had been treating under a flag of truce was not reassuring. In September a launch belonging to Regla took an American vessel; indeed, the captain-general is said to have declined to pursue a search for goods taken from a Boston vessel for fear "all Regla would be found to be implicated in the robbery." The brig *Laura Ann* of New York, laden with jerked beef from Montevideo, was taken and burned in October, only one of the crew escaping. The first hiding-place he found after swimming ashore among the sharks was stored with plundered goods, "which induced him to clear out and proceed from that scene of horror." A month later the *Edward* of New York was taken by four boats off Cape Maysi; and all but four of her crew were murdered. Evidently an American squadron was required in the West Indies when Commodore Porter was ordered on October 14 to return to his station.

The critical reporter at Havana explained the temper of the Spaniards in regard to piracy: the pirates themselves said that they robbed only the enemies of Spain; and others pointed out that Spanish merchants had sustained immense losses from captures made by Colombian or other privateers commanded and partly manned by citizens of the United States; thus the conduct of our

government was no less reprehensible than that charged against the Spanish authorities, even if they chose to connive with pirates —with whom most public officials in Cuba were allied by a "pecuniary interest." The envoy urged the seizure of vessels belonging to towns where pirates were fitted out or received and the levy of contributions as a further penalty. His remark that, "the suppression of piracy and the transportation of specie are incompatible" drew a remonstrance from Porter, who showed that his ships had transported less than $400,000 and had gained but a trifle by that current practice. On the whole, the commodore proved that his forces had been judiciously disposed and actively employed up to the date of his return to the West Indies in October, 1824, though neither the President nor the Secretary concealed their disapprobation of his withdrawal in June.

The commander of the *Porpoise* reported that his boats had searched the coast to the eastward of Matanzas, and on October 22 had taken a pirate schooner and an American cutter, finding evidence on board these vessels that several prizes had been robbed, not without murderous incidents. Three pirates were taken and delivered to the authorities at Matanzas for trial. The next notable exploit of our West Indian squadron, which numbered 13 vessels until the *Ferret* was capsized in a squall, was the capture of a pirate schooner in the same region by the boats of the *Sea Gull* supported by those of H. B. M. S. *Dartmouth*. The rover anchored close to the mangroves and fought ten minutes before his crew began to swim ashore. Five of them were killed, and 19 captured. This vessel pretended to be a Spanish privateer, but it was believed that she had lately robbed the brig *Betsey* of Wiscasset and murdered her crew. Another ghastly tale was related of 13 bodies found tied to trees near the point where this pirate was captured. The British forces made another capture in this spring of 1825, judiciously hiring a small steamer to assist their boats.

Diplomatic relations with Spain and the financial affairs of several officers of the squadron were complicated by the seizure of certain vessels which the federal courts would not condemn for piracy. Thus the *Spark* had taken the *Ninfa Catalana* off Havana in October, 1822, because an American captain had reported that some such Spaniard had plundered his vessel; but the judges at Norfolk released the prize and awarded damages against Lieutenant Wilkinson, U. S. N., which amounted to $12,000 before

Congress provided for his relief in 1827. The *Carmen,* taken by the *Peacock,* was also cleared, and Captain Cassin was accused of malicious contrivance by the Spanish minister because he sent the crew to Pensacola and the vessel to New Orleans. The courts at Charleston were not apt to show favor to our naval officers, as appeared by the famous decision in the case of the *Panchita* in 1822; and even condemnation did not ensure a reward for the captors. Thus Lieutenant Kearney petitioned Congress in regard to the condemnation of three piratical craft and two other vessels recovered from the pirates. These had been taken in 1821 by the *Enterprise,* but the costs had amounted to more than the pirates' vessels sold for, and most of the salvage allowed had gone the same way. Kearney asked that part of the $9000 paid in duties on the cargoes he had brought in might be allotted to the officers and men of his ship for "the risk and trouble they have had in the capture aforesaid"; but it does not appear that any general measure of relief was carried out for the benefit of the survivors or the families of those cut off by hardships or epidemics.

THE HARBORS OF PORTO RICO

This island was the storm-centre of Porter's campaign against piracy for special reasons which deserve consideration. In the first place, it was notorious for the privateers which sailed to harry the commerce of neutrals with Mexico and the Main to bring spoil to San Juan or Ponce. Both British and American protests abound in denouncing the conduct of these loosely commissioned rovers—their letters of marque under the royal seal and signature were sent out from Spain in blank and the names and dates were inserted at the discretion of some naval officer, usually one acting as captain of the port; they took vessels engaged in lawful trade within or without the limits of the 1200 miles of coast over which three vessels of the Spanish navy, a frigate, a brig, and a schooner, pretended to maintain a blockade; the right of search which they claimed often led to thefts from vessels which they dared not seize; and their inhuman dealings with captives of all sorts were notorious. They could not keep the seas clear of the privateers which used the flag of Colombia or Buenos Ayres or hold filibustering in check, but they were notorious disturbers of traffic.

Of the dozen privateers which hailed from Porto Rico in 1822, the *Panchita* or *Palmyra*—names could be shifted to suit the

papers in hand—was destined to become the most notorious. In August, 1822, Lieutenant Gregory, U. S. N., had his facile indignation aroused by the statement of an American captain whose brig had been robbed by a boarding-party from a vessel like the *Panchita;* and the young captain of the *Grampus*—who was to survive the war which ended in 1865—resolved to call her to account when the ships met at sea. His opportunity came on August 15, and the *Panchita* was overhauled and summoned to surrender, a demand which the Spaniard affected not to understand, though the *Grampus* lay within pistol-shot under her lee; " while repeating the demand he poured into us a full volley from his small arms and cannon, which was instantly returned and continued three minutes and a half, when he struck his colors, a complete wreck, having one man killed and six wounded." The water was up to the cabin floor when an American officer took charge and " laid her over on her side by shifting the guns " to stop the leaks. Gregory landed the wounded in Porto Rico and carried the prize with 77 of her crew to Charleston.

The Spanish account relates that the *Panchita* had the Spanish ensign aft and a white flag at the fore—which was not denied—and that she stood for the *Grampus* to deliver an official letter until Gregory fired and " assassinated " one of her crew. The Spanish minister accordingly applied for redress: " The Spanish flag has been insulted and attacked; Spanish citizens killed and wounded; Spanish property plundered and carried away on the high seas." He added that the captor had kept his prisoners in irons and otherwise ill-treated them on the voyage and at St. Thomas, where he had " celebrated his victory with feasting and drinking."

Gregory thought he had treated a company of pirates as well as they deserved; a third of them, he said, belonged to " the Sugar Key gang " and had resorted to Porto Rico " for the purpose of covering their villany with Spanish commissions." Some were ready to turn informers, and much crime might be disclosed. But the evidence failed to satisfy the federal court at Charleston, Judge Drayton ruling on October 8 that the *Panchita's* commission was " a regular one of a private armed vessel, and that the acts of such part of the crew as have committed depredations on our commerce subject them only to punishment, and do not create a forfeiture of the vessel." Gregory wrote to the *Charleston*

Gazette, "If I know anything, I hope I know the duties of my profession"—which seemed in that day to include writing for the journals; and he restated the evidence to show that he had not brought in a prize without strong grounds for her condemnation: two of the crew were recognized as belonging to the Cape San Antonio band of pirates; the *Panchita* or *Palmyra,* whose commission did not fit her tonnage, had boarded vessels while flying the French or Venezuelan flag instead of her proper colors; and her papers had been illegally extended. He disclaimed any intention of criticizing the court, though he had to appeal against an award of damages; but his opinion that there had been a miscarriage of justice seems to have been shared by Adams, the next President, who was then Secretary of State, and financial relief was doubtless granted.

Lieutenant Gregory had hoped that his action would not cause a coolness between the United States and Spain; but the Americans and English in Porto Rico were in need of protection when the wounded were brought in; and the story of the *Panchita* embittered the relations of our naval officers with the people and government of the island for years. Excitement was renewed when the schooner got home after her release; and Porter found that the affair had not been forgotten when he arrived on the station. He had fortunately been preceded by the *Cyane,* in August, 1822. Captain Spence sent a daily letter to the governor during a week in port, demanding and securing the release of one American crew and commenting severely upon the whole course of privateering in Porto Rico and the paper blockade. As for the *Panchita,* her conduct had been piratical; moreover, "What armed vessel could expect to fire on an American man-of-war with impunity?" The governor did his best to baffle the flow of discursive criticism by pleading ignorance or lack of authority; but Spence got what he had most urgently demanded. The gallant captain wrote in forwarding his correspondence to the department with obvious complacency that, "It cannot, however, be expected that an officer who embarked at the age of eleven on an element where the accomplishments of a scholar are not required, should shine in a correspondence of a diplomatic cast." Whether he found it inconvenient or not to be without an interpreter capable of rendering the Spanish letters or not, Spence must have been proud of his ultimatum: the captain announced that, to prevent "maritime

anarchy," he meant to give convoy and "treat as an enemy . . . any privateer . . . that shall cause hindrance to the lawful voyage of an American vessel." Little more was heard of the privateers of Porto Rico after this; but the era of good feeling was to be long postponed.

Pirates were forming colonies on the islands around Porto Rico, and the capital had lately been alarmed by a filibustering expedition which had sailed from New York to revolutionize the colony when Porter's squadron appeared on the north coast in March, 1823, and the commodore sent a communication to the governor. As the despatch-boat failed to return on March 4 the U. S. Schooner *Fox* was sent in to demand a reply. As she stood in for San Juan harbor warning guns were fired from the fort; the first shots were wide, but the vessel was struck at the fourth fire; and Lieutenant Cocke, her commanding officer was killed. Porter witnessed this outrage, and he disdained the forms of diplomacy in remonstrating with the governor: "Your excellency must be aware that it is always in my power to retaliate." Regrets were expressed promptly enough; the governor had been absent; subordinates were on the watch for another filibustering expedition; the shots were fired as a warning only; and the fatal fourth had been aimed high, hitting because of bad pointing or the heave of the sea. Lieutenant Cocke was to blame for crowding sail after the first warning; and the officer who had preceded him had been remiss in reporting. All these excuses the commodore denounced on March 11 as unworthy subterfuges; "Your officers may have thought this a fair opportunity to retaliate" for the affair of the *Panchita*, which the governor had indiscreetly mentioned: "I have satisfied your military officers that their force is despicable compared with that at my disposal, and I have convinced the inhabitants that, though they are at my mercy, they will not be made answerable for the offenses of an individual."

Porter's original communication had been less truculent: he asked cooperation in the suppression of piracy; and, in view of the complaints made against the Spanish privateers, he desired a descriptive list of those sailing from Porto Rico, with a set of blank forms for verifying their papers. How far they had been instructed to interfere with our trade to Mexico and other revolted provinces was also a matter of concern. The documents required were furnished, with the information that all commis-

sions were sent out in blank and completed by naval officers on the station; and the commodore was informed that the Venezuelan blockade had been raised, except for contraband, while the Mexican situation was uncertain. If the governor's stipulations were observed there could be little further danger from Porto Rican privateers, and no specific charges seem to have been filed against them in 1823, though the President denounced their methods in his annual message.

The decline of privateering, like the check which the slave-trade and more legitimate branches of commerce had suffered, tended to furnish recruits for the revival of unlicensed piracy; and the temper of the maritime population and the officials of the island may have accepted that pursuit as the only way to get even with the Americans. Both ends of Porto Rico border straits opening into the Caribbean; and the islands of Mona in the west and Vieques (Crab Island) in the east are convenient strategic outposts for preying upon commerce, as the buccaneers had long since demonstrated. Vieques might also serve to check the depredations of the notorious filibustering privateers who haunted St. Thomas while cruising for the new republics of Spanish America. Porter heard in January, 1824, that there might be found on the island of Mona "an establishment formed by the piratical population of Porto Rico" and said to be well-armed. He therefore directed Lieutenant Newton, who was about to sail in the *Spark* to search the southern coasts of Porto Rico and Santo Domingo, to seize the place and destroy all the boats which the pirates had collected, "thus cutting off their retreat"; but it does not appear that the expedition had any success. A more fortunate enterprise was planned in March, 1825, for extirpating certain outlaws established at Vieques. Considering all that had happened in Porter's cruise in these waters, it is surprising to find Spanish officials in Porto Rico capable of cooperating with the American Navy. Yet they consented to aid Lieutenant Sloat of the *Grampus* in pursuing a native of the island who had won fame as a pirate; and the men of the *Grampus* embarked at Ponce in a vessel owned and commanded by a Spaniard, the allied forces sailing for Crab Island on March 2. The chief pirate was Roberto Cofusi, a Porto Rican sailor of 26 years, who had lost his first vessel at Mona in 1824, and had been sentenced for six years for his crimes. Escaping from prison without delay, he resumed his

trade, and he was credited with seven or eight prizes before his career came to an end. He denied, however, that he had ever murdered his captives. He had only 14 men and a small sloop at Vieques, and he was constrained to hide his vessel among the mangroves in the narrow harbor called Boca de Infierno. The Spanish sloop found her way in with some hazard, and one pirate was slain and three taken with their vessel. The rest escaped for a time; but Cofusi was taken by Spanish soldiers that night; and his comrades within a few days. They were carried to San Juan and tried by court-martial on March 27, and two days later they were executed. Though they alleged that the crews of their eight prizes had been spared, rumor had it that they had murdered 400 men.

Five months before this episode was over Commodore Porter had committed the act that resulted in his exit from the service in which he had won so much honor; "the extraordinary transactions at Foxardo," as Secretary Southard called them—Fajardo is the Spanish name, but the navy never learned that spelling—were the culmination of two years of controversy and irritation. In October, 1824, Lieutenant Platt of the *Beagle* was told that the store-house of an American merchant acting as consul at St. Thomas had been robbed of goods to the value of $5000, and that it was suspected that the spoil had been carried to Foxardo for delivery to a local trader in stolen property. No proof confirming this conjecture was ever secured; but Platt thought it his duty to cross to Porto Rico and make search for the goods with the aid of one of the consul's clerks. He committed the tactical blunder of going ashore in plain clothes, but he presented himself to the alcalde of Foxardo as an American officer and thought that he had obtained a promise of cooperation. A few hours later the alcalde, apparently intimidated by the townsmen, ordered Platt's arrest; and he and two companions were not released until his commission and his orders to command the *Beagle* were produced. As Porter declared after the affair had been reported to him, an officer in search of freebooters had been arrested and insulted; and he felt bound to exact an apology—though not to prosecute the search.

On November 12, 1824, the *John Adams, Grampus* and *Beagle* anchored off the mouth of the Rio Fajardo, and marines were landed to spike the guns of the shore battery. The commodore then

marched inland to summon the town. The alcalde was invited to come out with the captain of the port to give satisfaction for the shameful affair: otherwise the competent force then present—the commodore had a strong battalion while the Spaniards could only array "an irregular assemblage of armed men"—would proceed to punish the aggressors and, should resistance be offered, to destroy the town. The alcalde obeyed, of course, realizing that he had to deal with a man who was *pundonoroso;* and the commodore withdrew his forces after a full apology had been made to Lieutenant Platt in his presence. He said afterward that had he been called to account for failing to seize or destroy Foxardo and its *marina* "as pernicious nests of pirates" he should have regarded himself in more danger than when confronted with the charge of committing acts of hostility against the subjects of the king of Spain. At any rate, his men were kept in hand; and they are not charged with plundering or drunkenness. The Spanish story of their "precipitous retreat" need not be taken seriously.

As soon as his report reached the department Porter was ordered on December 27 to turn over the command and proceed to Washington. The court of inquiry was followed by a court-martial in due course; and Porter, though Barron whom he had helped to try in 1807 was president of the court, and the eccentric Elliot, the foe of every ally of Perry and Decatur, was among the members, objected only to the judge-advocate. The first charge coupled disobedience of orders with unbecoming conduct rather awkwardly, but the specification was impregnable when compared with Porter's instructions; the charge of insubordination related to the commodore's habitual use of the press in all controversies. With the sentence of six months' suspension was coupled a tribute to his zeal for the service; but he promptly resigned his commission because he "could not associate with those who were led away by men in power to inflict an unrighteous sentence"; and he liked to believe that the affair had injured the Adams administration. General Jackson, whose example in pursuing "land pirates" in Florida had been invoked in the defense, offered to restore Porter to the navy, but finally made him minister to Turkey.

Porter was convicted on August 10, 1825; and the Secretary of the Navy congratulated his successor, Commodore Warrington, a month later on "the subdued state of piracy within the sphere of

your operations." Relations with Spanish authorities had manifestly improved before Porter was relieved: thus in January he had exchanged compliments with Captain-General Vives and received a certificate that he had "respected the territorial rights" of Cuba throughout his cruise; and, though the Spanish minister had denounced his conduct in May, 1825, he offered no testimony on his trial for the Foxardo incident. In fact, he had said that the President's action in relieving the commodore and ordering a court-martial would doubtless satisfy his Catholic majesty of Spain. When it was rumored that Porter was resolved to create a Mexican navy offers were made with reference to the reward of $60,000 which he had earned at New Orleans in 1807; but the commodore was not to be tempted.

In 1825 the governor of Porto Rico directed all his subordinates to aid American cruisers in suppressing piracy; and one instance of effective cooperation has been cited. A committee of Congress reported in January upon the evils of piracy and lawless privateering: proposals for reprisal and the blockade of Cuban ports were debated; and it was held that merchantmen might arm to defend themselves, but that the law which required bonds to prevent the improper use of arms—the Secretary of the Navy had declared this restriction to be indispensable—should be maintained. Though Spain had made no offer of reparation she had promised to send a new minister to Washington. The cessation of hostilities between Spain and her colonies brought partial relief before 1830; but piracy without political pretense was not infrequent during this period. Thus one crew of Spaniards was brought to justice at Gibraltar in 1829, after their spoil had found a market in Spain; and another was hanged in Boston in 1835, for robbing an American brig, having been arrested by a British cruiser.

Porter became commander-in-chief of the Mexican Navy in 1827, and again found employment in the West Indies, making Key West his headquarters until an American squadron induced him to withdraw. From Vera Cruz he had issued an invitation to corsairs of all nations to cruise against the ships and goods of Spaniards. Spanish cargoes might be taken from neutral ships, and the prizes were to be brought to Vera Cruz if possible, though Porter allowed his cruisers to sink or burn captured vessels and to seize spoil on shore in Cuba. The report of the Secretary of the Navy for 1827 did not name the commodore, but, after stating

that there had been no recent piracies in the West Indies, added that the "only unpleasant occurrences afloat" were due to his occupation of Key West and his indiscreet invitation to privateers. In both cases, our cruisers were ordered to protect our commerce and neutrality; but there proved to be no necessity for the employment of force. The harbor was evacuated as soon as the Spanish men-of-war, which had begun to cruise effectively at last, were out of the way; and a treaty with Mexico put an end to irregular privateering.

The officers and men who pursued the West Indian pirates had few opportunities to gain honor or reward in naval engagements, but their experience in navigating unsurveyed coasts and channels must have advanced their professional capacity. No prize-money could have balanced the risk of health involved by climatic exposure, but the release of so many prizes by the courts was a sharp disappointment to many. The mortality from yellow fever was a painful blow to the service; Lieutenant Watson only lived a few months after his defeat of Diablito; and many officers who, like Farragut, Kearney, and Gregory, might have survived to take part in or witness the Civil War, sacrificed their lives on the coast of Cuba or at Key West. Sanitary science had done little for the sojourner in the tropics in that age; and an epidemic might be regarded as an inevitable feature of any protracted cruise in the Caribbean or the Gulf of Mexico.

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PERSONNEL LEGISLATION.

By Lieut.-Commander J. H. Tomb, U. S. Navy.

It is safe to say that there are as many ideas in the navy relative to what the service requires in personnel legislation as there are officers and men in the service. The personnel act of 1899 remedied a very serious condition of affairs by bringing more rapid promotion and by amalgamating the line and engineer officers. The act improved the conditions as they existed in 1898, but all of us realize that another hump is forming. To create a system that will take care of this hump and permit a healthy flow of promotion without doing injustice to the individual is indeed a hard problem to solve. In attempting to do justice to the individual, a large and costly retired list is liable to result and the mere thought of such a list is sufficient to kill any remedial legislation.

The problem, therefore, is to maintain a healthy flow of promotion, be just to each individual concerned and keep the cost of the retired list down. The question certainly is difficult of solution and in solving it every officer is prone not to think so much of "What is best for the service?" as "How does it affect me?"

Suppose the total displacement as given in the present bill before Congress be considered. This displacement of 1,200,000 tons used as a basis would result in the following:

Number of enlisted personnel	60,000
Number of line officers	3,000

The 3000 line officers would be distributed as follows, according to the bill:

30	Flag officers	1 Admiral.
		5 Vice-admirals.
		24 Rear-admirals.
120	Captains.	
150	Commanders.	
390	Lieutenant-commanders.	
900	Lieutenants.	
1410	Lieutenants (j. g.).	
	Ensigns.	
	Midshipmen (all at Academy).	
3000		

This number in each grade would result if 3000 line officers and midshipmen were in the service. Such is not the case, however.

An examination of the register of the navy shows that the number of line officers, exclusive of extra numbers, amounts to about 2350, of which approximately 700 are midshipmen at the Naval Academy. If this number, 2350, were distributed in the proportion given above there would result:

23	Flag officers	1 Admiral.
		4 Vice-admirals.
		18 Rear-admirals.
94	Captains.	
118	Commanders.	
305	Lieutenant-commanders.	
705	Lieutenants.	
1105	Lieutenants (j. g.).	
	Ensigns.	
	Midshipmen (all at Academy).	

As ensigns cannot be promoted until after seven years' service, there would be only 650 lieutenants instead of 705 and there would be no lieutenants (j. g.). This would make the list top heavy and this condition is taken care of in Section 11, which provides:

That until the full authorized strength of the grades above ensign and below admiral of the navy shall have been once attained, the actual strength of said grades on July 1 of any year shall be distributed in the proportions as required by section four of this act, down to and including lieutenants, together with a proportionate number of 12 lieutenants (junior grade), a fractional surplus in any higher grade to be neglected in that grade and carried to the grade below: Provided, that the authorized strength of any of said grades at the date of passage of this act shall not be hereby reduced. The promotions of officers for total length of service, as required by section ten preceding, shall begin on July 1 following the passage of this act, and shall continue on the first day of each fiscal year thereafter. The numbers in the several grades determined by the requirements of this act for any year shall obtain throughout the fiscal year, and vacancies occurring during the year shall, subject to the provisions of section ten preceding regarding the promotion of ensigns, be filled in order of seniority from the grade below.

It therefore becomes necessary to consider the actual number of officers on the list from rear-admiral down to and including those officers who have completed seven years service. This amounted to 1186 officers on July 1, 1911. The proportion to be used in considering this number of 1186 would be: 1 flag officer,

4 captains, 5 commanders, 13 lieutenant-commanders, 30 lieutenants and 12 lieutenants (j. g.).

This would result in the following:

22 Flag officers	1 Admiral.	
	3 Vice-Admirals.	
	18 Rear-admirals.*	Senior in Grade.
72 Captains		C. J. Boush.
112 Commanders *		G. W. Kline.
237 Lieutenant-Commanders		Y. Stirling, Jr.
547 Lieutenants		B. A. Long.
196 Lieutenants (j. g.)		W. T. Mallison.

* Present number cannot be reduced.

In addition to the above, there would be about 460 ensigns. There would be no midshipmen at sea.

To fill all the vacancies in the line by this bill, if the enlisted personnel were to be increased to 60,000, would require 500 more midshipmen to be appointed this next year to the Naval Academy than would ordinarily be the case. This is taken care of in Section 7, which provides that no entering class shall be more than 10 percentum of the authorized strength of the line. Therefore, with the authorized strength of the line as 3000, no entering class can be greater than 300. This would spread the increase over a term of years and prevent abnormally large classes.

The provisions of retirement incorporated in this bill will not be enforced for at least fourteen years, and in a few years after it is enforced, large numbers of retirements will result. Some provision must be made to keep the retired list actively engaged so as to be of active use to the government, and further on in this paper is suggested a method of actively employing the retired list without interfering with shore duty assignments for the active list. The compulsory retirement to give vacancies should take place before promotion and not after, as it is manifest that any officer advanced may be retired immediately, and it is evident that in time of war such officer would not be fit to execute the duties of his advanced rank were he called into service. This would result in retirements of lieutenants and a clause to this effect is required, but their retired pay should not be below $1000 per annum. A retired officer serving on active duty should of course receive the pay and allowances of his grade.

By this bill, an officer, unless sooner promoted to fill vacancies, must be promoted:

To Lieutenant (j. g.)	after	7	years	service
To Lieutenant	"	10	"	"
To Lieut.-commander	"	18	"	"
To Commander	"	24	"	"
To Captain	"	37	"	"

Taking eighteen years as the average entrance age of those line officers at present in the service, the average ages of promotion would be:

To Lieutenant (j. g.)	25	years	of	age
To Lieutenant	28	"	"	"
To Lieut.-commander	36	"	"	"
To Commander	42	"	"	"
To Captain	47	"	"	"
To Rear-admiral	55	"	"	"

Any officer of the grade of rear-admiral selected for retirement should be retired with pay and rank of captain, unless he has served as rear-admiral as described later on in this paper.

It cheapens the grade of rear-admiral to have officers retired in this grade who have not performed the actual duties required of that grade and who have never commanded a fleet, squadron, division or even any kind of craft afloat.

A study of conditions as they existed in 1898, 1899, 1900, 1905 and 1910, may be of interest. Below are tables showing the conditions of each grade in the line in the years named above. In 1898 and 1899 the engineer officers are counted with the line relative to numbers, but line officers only are considered in computing ages, etc.

FLAG OFFICERS, LINE.

In 1898 and 1899, rear-admirals and commodores are considered in one group in first table and in separate groups in next two tables:

January 1	1898	1899	1900	1905	1910
Number	16	17	18	26	28
Average flag service.....	4.6 yrs.	4.9 yrs.	5.0 yrs.	3.2 yrs.	2.3 yrs.

REAR-ADMIRALS.

	No.	Average service as Rear-Admiral.	Average service as Commodore.	Average total Flag service.
		Years	Years	Years
1898	6	2.1	2.2	4.2
1899	7	2.6	1.8	4.4

COMMODORES.

1898	10	...	...	5.0
1899	10	...	...	5.4

CAPTAINS.

Jan. 1st of year.	No. in line.	No. in eng. corps.	Total.	Age of oldest.	Age of youngest.	Average age.	No. of years to pass through grade.
1898	45	11	56	58.9	51.4	55.2	10.5
1899	45	11	56	59.9	52.4	56.2	7.8
1900	70	..	70	60.9	53.3	57.1	7.8
1905	86-a	..	86	60.6	54.1	57.3	5.8
1910	81-a	..	81	61.2	51.5	56.3	3.6
July 1, 1911				60.9	47.7	54.3	4.0

a. 70 allowed by law.

COMMANDERS.

1898	85	15	100	61.7	49.5	55.6	13.0
1899	85	15	100	60.4	50.5	55.4	12.5
1900	112	..	112	61.3	49.1	55.2	6.6
1905	122-b	..	122	57.7	48.1	52.9	5.1
1910	119-b	..	119	54.8	40.5	47.7	4.0
July 1, 1911				50.3	39.5	44.9	3.0

b. 112 allowed by law.

LIEUTENANT-COMMANDERS.

1898	74	8	82	52.4	47.7	49.7	6.5
1899	74	1	75	52.3	48.1	50.2	5.7
1900	170	..	170	53.3	42.0	47.6	2.9
1905	199-c	..	199	50.9	38.0	44.4	5.8
1910	211-d	..	211	43.5	31.6	37.6	4.5
July 1, 1911				41.0	31.3	36.2	5.1

c. 191 allowed by law.
d. 200 allowed by law.

LIEUTENANTS.

Jan. 1st of year.	No. in line.	No. in eng. corps.	Total.	Age of oldest.	Age of youngest.	Average age.	No. of years to pass through grade.
1898	250	72	322	50.5	34.6	42.6	21.5
1899	250	69	319	50.6	34.9	42.7	19.0
1900	300	..	300	44.7	28.0	36.4	0.9
1905	343-e	..	343	41.0	24.9	33.0	5.8
1910	319-f	..	319	35.6	24.2-g	29.9	6.0
July 1, 1911				35.1	24.2-g	29.7	6.0

e. 336 allowed by law.
f. 350 allowed by law.
g. Approximate age, no data at hand.

A re-arrangement of above tables will show the following points:

No. of years to pass through grade of	Year. 1898	1899	1900	1905	1910	July 1, 1911
Captain	10.5	7.8	7.8	5.8	3.6	4.0
Commander	13.0	12.5	6.6	5.1	4.0	3.0
Lieut.-commander	6.5	5.7	2.9	5.8	4.5	5.1
Lieutenant	21.5	19.0	0.9	5.8	6.0	6.0

Average age in grade of	Year. 1898	1899	1900	1905	1910	July 1, 1911
Captain	55.2	56.2	57.1	57.3	56.3	54.3
Commander	55.6	55.4	55.2	52.9	47.7	44.9
Lieut.-commander	49.7	50.2	47.6	44.4	37.6	36.2
Lieutenant	42.6	42.7	36.4	33.0	29.9	29.7

Number of line officers (line officers and engineer officers included together for 1898 and 1899):

No. of officers.	1898	1899	1900	1905	1910
Allowed	921	911	1,020	...	....
Actual	893	872	881	959	1,152

The enlisted personnel allowed by law on January 1 of year indicated was as follows:

1898	1899	1900	1905	1910
11,750	13,750	20,000	34,000	47,500

Number of line officers per 100 men of enlisted personnel (only actual number of line officers considered and including engineer officers with line officers in 1898 and 1899):

1898	1899	1900	1905	1910
7.6	6.3	4.4	2.8	2.4

A study of the above tables shows that officers of flag rank held such rank twice as long in 1898 and 1899 as in 1910, that is, the average age of flag officers has materially increased since 1898. The average age of captains increased to 57.3 years in 1905, but has decreased to 54.3 years on July 1, 1911. The average age of commanders has decreased from 55.6 years in 1898 to 44.9 years on July 1, 1911. The average age of lieutenant-commanders has decreased from 50.2 years in 1899 to 36.2 years July 1, 1911, a decided change. The average age of lieutenants has materially decreased, decreasing from 42.7 years in 1899 to 29.7 years July 1, 1911. Therefore, the result of the Personnel Act of 1899 has been to materially decrease the ages in grades below captain, but in the flag grade the average has increased.

The length of service in each grade has decreased, giving a healthy flow of promotion, but this healthy flow cannot continue with rapid increase of officers. Also, under the present conditions, it is impossible to have rear-admirals with a sufficient length of service in that grade.

On January 1, 1912, there will be approximately 140 lieutenants (j. g.). On January 1, 1913, this number will be increased to approximately 205, and on January 1, 1914, to 390, and in 1915 to about 500. On January 1, 1919, there will be about 950 lieutenants (j. g.).

It is apparent that the navy is going back to the deplorable condition existing in 1898, with lieutenants 50 years old.

There is a general apathy throughout the service to the conditions confronting the commissioned personnel. Those who are above the rank of lieutenant, junior grade, do not fear marking time and this creates a general desire that things take their course. This is bad, as the best way to cure the service of the evils of a hump is to avoid a hump from forming.

The present bill before Congress does this, but meets with considerable opposition in the service and in Congress. Some of the opposition in the service is due to the fact that those maintaining the opposition are just naturally "agin the government," but most of the opposition is real and earnest. Very few in the service are in sympathy with the clause in the Personnel Act of 1899 allowing an officer retired by the plucking board to retire with advanced rank. This principle was fair in 1899, when officers of the lieutenant grade and above were so old, but this condition in the junior grades no longer holds good. Its absurdity under present

conditions was shown at the last plucking when an officer only 40.8 years old, in excellent health, was retired with the rank of captain, thereby receiving $3750 per annum the rest of his life, after only 25 years service. The greatest service opposition to the bill now before Congress is due to the fact that there is no really just way in which an officer may be selected out. The personal element may be so strong as to cause an officer to be selected out unjustly on one-third pay. If the service could be sure that only the least efficient would be plucked, the strongest part of service opposition probably would disappear.

The opposition in the service to the present bill, therefore, embraces the conditions:

(a) No system of plucking in existence that has the confidence of the service relative to being just and fair to all concerned.

(b) Plucking an officer after 18 years service with small pay.

The opposition in Congress arises from three sources as follows:

(c) A feeling that able-bodied men capable of doing work will be paid by the government for doing nothing.

(d) The cost of the retired list will increase, although it will decrease per capita.

(e) The opposition of the service to the bill bringing influence to bear.

There are, therefore, five conditions to be met before the opposition of the service and of Congress can be eliminated.

Before going any further, attention should be invited to the remarks on Navy Personnel Reform, recently compiled by the Department, from which the following paragraph is quoted:

> Objection is sometimes made to the retirement of able-bodied officers. This in itself might be considered objectionable, but if there is no increase of total cost, and if there is great gain of efficiency, should the objection be regarded as valid? Moreover all such officers form a reserve in time of war. Some countries go to considerable expense to create such a reserve. With us this reserve would cost nothing. Here is a very strong argument in favor of the method, apart from the very material advantages that are the chief object.

The reserve described above is a latent reserve and would cost a great deal when retired pay is considered. Why not have an active reserve? Our naval militia is hard pressed for proper training and our training stations for apprentice seamen have to

depend on warrant officers and chief petty officers in drilling the men. The reserve mentioned above could be utilized with great advantage to the service by being actively engaged in the duties of instructing and training the naval militia and in training the apprentice seamen. The resultant expansion of the naval militia probably would keep all the reserve actively engaged.

To come back to the causes of the two objections by the service and the three by Congress, the five causes must be met to produce cohesion and, therefore, each of the five objections, with a suggestion for removing same, will be considered below.

Service objection due to condition "a," that is, a fair and just system of plucking. This condition requires a decided change, but no legislation is needed for it. The reform can be made by the Department without act of Congress.

Efficiency reports, although better graded now than in the past, give only an approximate idea of the worth of an officer. In filling responsible assignments, the Department wants to know the relative efficiency of each of the officers so as to pick the one best fitted for an important post.

At present, in selecting an officer for an assignment, the officers on duty at the Department may be consulted so as to make as good a selection as possible, but in this case an officer not known to these officers at the Department would be overlooked. Not only will the below-described system keep the Secretary of the Navy informed as to the service estimate of a man, and therefore the most correct estimate, but it will also prove invaluable in selecting out, reflecting as it does the opinion of the whole service, which opinion will be just about correct. The system will also eliminate personal influence, politics and any personal ill feeling relative to an officer in selecting out and will give the examining board a fair and square idea of an officer's value to the service.

This system is illustrated as follows: By March 15 of each year the "Register of the Commissioned and Warrant Officers of the United States Navy and Marine Corps" of the preceding January 1 will be carefully studied by each rear-admiral and captain on the active list. As a result of this system reports will be made by each rear-admiral and captain as follows: Each rear-admiral on the active list will report on the captains and commanders. Each captain will report on commanders.

In making these reports, the officers must each make out his own report without assistance from others and must certify on submitting the report that it is made out in accordance with his belief and that he has consulted no one to assist him in making out the report, swearing to this by signing an oath, which oath is part of the form of the report and must be signed to make the report valid.

Below is illustrated how the rear-admirals report on the captains.

The below list (for example) shows the active list of captains as appearing in the register for January, 19—. Only ten fictitious names appear, as such number is sufficient to explain the idea.

	Captains.	Secret number assigned by Department (assigned by board after reports are received).
1	John Horace Adams	7
2	Henry Louis Smith	8
3	Benjamin Arthur O'Connor	9
4	Albert Herbert Ford	10
5	Richard Henry Jones	1
6	Thomas Ralph Butler	2
7	Joseph Charles Foster	3
8	Clarence James Fisher	4
9	Robert Edward Reyburn	5
10	George William Martin	6

A rear-admiral, looking over this list and studying it, will submit, for example, his estimate of the ten captains by arranging their names in the order of value as follows:

1 G. W. Martin.
2 B. A. O'Connor.
3 H. L. Smith.
4 C. J. Fisher.
5 J. C. Foster.
6 R. E. Reyburn.
7 R. H. Jones.
8 J. H. Adams.

As the rear-admiral concerned has no personal knowledge of the abilities of Captains A. H. Ford and T. R. Butler, he does not name them in his report. As all rear-admirals report on the captains, Captains A. H. Ford and T. R. Butler are bound to be reported on, however.

A board of officers, sworn to secrecy, meeting at the Department, then assembles the reports, using only the number assigned by the Department and using no names. The numbers assigned by the Department are really assigned by this board of three officers and the number assigned to each officer is kept secret. Suppose, then, the result of averaging the report gives the following table, using the secret numbers as stated above.

Secret No.	Average standing.
8	1.68
6	1.90
2	2.30
9	2.85
3	3.20
10	3.60
4	4.70
1	5.80
7	6.40
5	7.50

The final relative standing of the captains would, therefore, be:

Secret No.	Standing.
8	1
6	2
2	3
9	4
3	5
10	6
4	7
1	8
7	9
5	10

In case it were required to select out three captains, the Selecting-Out Board would naturally select out the captains assigned secret numbers 5, 7 and 1. If, however, secret numbers 4 and 1 are a tie, the board would have before it all remarks that appear on the records of 4 and 1 and would have to use its discretion in selecting out either 1 or 4.

In selecting out lieutenant-commanders and lieutenants a different system will have to be employed, but the secret number idea would still be employed.

All commanding or senior officers reporting on lieutenant-commanders, lieutenants, lieutenants (j. g.) and ensigns must be thoroughly conscientious in making efficiency reports. A weak officer is liable to give perfect or nearly perfect marks to the officers serving under him and thus give the officer higher marks than he deserves; or, due to personal reasons, is liable to give marks lower than deserved. A constant supervision over all reports by the Department will probably correct this evil. Moreover, the officers making reports are constantly shifted, so that a general average will be very near right. Therefore, the following system could be employed relative to selecting out lieutenant-commanders and lieutenants.

The fitness reports of every lieutenant-commander and of every lieutenant with fifteen years service to his credit will be considered for the five years previous to March 31 of the year in which the selection is made. A board of three officers, sworn to secrecy, will compile the result of all reports, the query "value to the service" being added to present fitness reports and the mark given to this query being used as a basis for the compilation. The board will arrange the list of lieutenant-commanders and lieutenants of over eighteen years service in accordance with the final average of each officer for the last five years and submit the two reports (one for lieutenant-commanders and one for lieutenants) to the Selecting-Out Board, the board settling the question of ties in the same manner as in the cases of captains and commanders.

The board of three officers arranging the secret list for captains should be rear-admirals, the board for commanders should be captains, and the board for lieutenant-commanders and lieutenants should be commanders. In this way no officer will get a secret line on his seniors, nor will he be working out his own relative standing.

In the past a great deal of criticism has been made on the system of forced retirements at present in effect. The greatest criticism is that personal dislikes enter strongly in selecting those to be retired. Although few believe that a member of the board would allow his dislikes or personal enmities to influence him in the discharge of his duties, there is no doubt that human nature is prone to faults and it may be that a member or members of the board may be swayed accordingly. The system described above in detail

will do away with personal likes and dislikes of the board and will eliminate favoritism, an essential requirement.

Criticism may be made that a superior may report on a junior in accordance with his knowledge of the junior years past. This may be true and for this reason no captain or commander should be reported on unless the reporting officer has had official relations with such in the ten years previous, or else has a thorough knowledge of the abilities of such officer from mutual associations in the last ten years.

This system should be applied to the staff corps, the directors being reported on by the chief of bureau and assistant chief of bureau of their corps plus the senior directors numbering 20% of such grade, the 20% making the report on the remaining 80%. The inspectors will be reported on by the directors and passed assistants by the directors and inspectors. This, however, can be better arranged by each corps developing its own system, as the duties are such that frequently no senior is able to report on a junior.

In the Marine Corps, however, such a system is applicable except in the case of colonels. It is, therefore, better that the Marine Corps devise a system that will enable reports on colonels to be made.

This system will probably eradicate opposition (a) of the service, but opposition (b) will have to be settled by act of Congress. It is, therefore, suggested that the act to employ retired officers on active duty be re-enacted but modified to meet the requirements outlined as follows:

Officers, when selected for retirement, will have their choice between the graded pay of the present Personnel Act before Congress, or active duty ashore, while, on the retired list, until they will have completed thirty years service, when they will no longer be employed and will receive three-fourths of the pay of their grade. Retired officers will serve at training stations, on general courts-martial duty and with naval militia organizations with officers on the active list, but officers on the active list of the same grade will take precedence over retired officers.

Below is given a table, showing the strength of the Naval Militia on January 1, 1910. This strength should be increased fourfold.

STRENGTH OF NAVAL MILITIA (ABOUT 107 DIVISIONS) JAN. 1, 1910.

State.	Commissioned officers.	Warrant officers.	Petty officers.	Men.	Total.
California	44	6	107	428	585
Connecticut	16	5	42	161	224
District of Columbia	14	..	50	93	157
Georgia	3	..	6	38	47
Illinois	50	..	114	473	637
Indiana	18	..	41	125	184
Louisiana	46	3	76	477	602
Maine	3	..	16	50	69
Maryland	17	5	110	162	294
Massachusetts	40	..	115	370	525
Michigan	41	..	66	233	340
Minnesota	11	..	17	106	134
Missouri	10	1	18	77	106
New Jersey	23	2	65	260	350
New York	52	..	90	678	820
North Carolina	32	4	70	258	364
Ohio	16	..	29	205	250
Pennsylvania	7	..	16	89	112
Rhode Island	15	2	49	160	226
South Carolina	19	..	37	150	206
Wisconsin	8	..	..	61	69
Total	485	28	1,134	4,654	6,301

Thus an officer with a family, selected for retirement, may be sure of ample means of caring for his family and the retired list will be actively engaged in serving the government. In time of war the retired officers actively engaged will first be called into service in their respective grades, and after them the officers not actively engaged and retired on graded pay. Three-fourths of those selected for retirement must serve on active duty. Officers retired for physical disability will not be considered in this relation, as such officers will be retired on three-fourths pay.

No officer will be advanced and retired except when coming up for promotion and physically disabled.

No officer shall be retired with the pay of rear-admiral unless he has served as such in command of a fleet, squadron or division for one year, or as chief of bureau. He may be retired with relative rank of rear-admiral, as at present allowed, except that he will not receive the retired pay as such, receiving the retired pay of captain only.

Rear-admirals serving as such in command of the following navy yards may be retired as rear-admirals provided they have

commanded a ship of first or second class in active service while making a cruise in the grade of captain, and provided they have been in command of the navy yard for one year while in the grade of rear-admiral.

NAVY YARDS.

Boston, Mass.
New York, N. Y.
Philadelphia, Pa.
Norfolk, Va.
Mare Island, Cal.
Puget Sound, Wash.
Washington, D. C.

It is not a credit to the service that 40% of the retired list of commissioned personnel should be of flag rank, while a large number have never commanded a ship and few have commanded ships of the first class and served as rear-admiral in the proper duties as such. Retired pay of flag rank is large and should be a reward for valuable service in that rank.

It is thought that these two systems will remove all opposition of Congress and of the service, if applied to the new Personnel Bill, and will result in younger captains and rear-admirals, a condition affecting vitally the efficiency of the service.

The question of number of enlisted and commissioned personnel is difficult of solution if a standard basis is to be applied. No standard will meet all conditions. In order to determine the number of men required, the following lists are appended. These lists show that approximately 1864 line officers and 61,564 men are required to man all ships of first, second and third rates, gunboats, torpedo craft, monitors and transports on January 1, 1913. The tonnage of 1,003,499 does not include colliers, which would be manned by merchant crews, nor does it include wooden receiving ships. This means 123 men per 2000 tons.

To the 1864 line officers above noted, as required to officer all of our ships, 25% should be added to allow for officers performing shore duty, on leave or sick leave, or changing stations. This results in 2330 line officers being necessary. To this should be added the 700 midshipmen at the Academy, which brings the total number around 3000. It is, therefore, seen that the 3000 officers and 60,000 men that would be authorized by the Personnel Bill are a necessity. The standard basis of five officers per 100 men per 2000 tons of displacement meets the conditions as well as any standard and

some standard should be adopted to produce the necessary results as, after all, the results are the main consideration, the standard used being of minor importance.

BATTLESHIPS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Indiana	10,288	19	619
Massachusetts	10,288	19	619
Oregon	10,288	19	619
Iowa	11,346	18	596
Kearsarge	11,520	19	636
Kentucky	11,520	19	636
Illinois	11,552	19	623
Alabama	11,552	19	623
Wisconsin	11,552	19	623
Maine	12,500	21	699
Missouri	12,500	21	699
Ohio	12,500	21	699
Virginia	14,948	24	795
Nebraska	14,948	24	795
Georgia	14,948	24	794
New Jersey	14,948	24	795
Rhode Island	14,948	24	794
Connecticut	16,000	25	841
Louisiana	16,000	25	841
Vermont	16,000	25	841
Kansas	16,000	25	841
Minnesota	16,000	25	841
New Hampshire	16,000	25	841
Mississippi	13,000	21	700
Idaho	13,000	21	700
South Carolina	16,000	21	701
Michigan	16,000	21	701
Delaware	20,000	25	827
North Dakota	20,000	25	822
Florida	21,825	25	824
Utah	21,825	25	824
Wyoming	26,000	27	905
Arkansas	26,000	27	905
New York	27,000	27	899
Texas	27,000	27	899
	555,796	795	26,417

47.5 per 1000 tons

Flagship of fleet (extra men required)	40
Seven divisions of 5 ships each—extra men for 7 flagships	160
Total for battleship fleet	26,617

Number of men equals 47.9 per 1000 tons.

ARMORED CRUISERS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Pennsylvania	13,680	23	776
West Virginia	13,680	23	776
California	13,680	23	776
Colorado	13,680	23	776
Maryland	13,680	23	776
South Dakota	13,680	23	776
Tennessee	14,500	25	839
Washington	14,500	25	839
North Carolina	14,500	25	839
Montana	14,500	25	839
Total	140,080	238	8,012
Two flagships (2 divisions)			46

Number of men equals 64.7 per 1000 tons.

CRUISERS, FIRST AND SECOND CLASS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Saratoga	8,150	14	451
Brooklyn	9,215	15	498
Charleston	9,700	20	650
Milwaukee	9,700	20	650
St. Louis	9,700	20	650
Baltimore	4,413	10	320
Chicago	4,500	11	350
Newark	4,083	9	282
Olympia	5,865	12	392
San Francisco	4,083	9	282
Total	69,409	140	4,525
Two flagships (extra men)			46
			4,571

Number of men equals 46 per 1000 tons.

SCOUT CRUISERS AND CRUISERS, THIRD CLASS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Birmingham	3,750	11	355
Chester	3,750	11	351
Salem	3,750	11	351
Chattanooga	3,200	9	292
Cleveland	3,200	9	292
Denver	3,200	9	292
Des Moines	3,200	9	292
Galveston	3,200	9	292
Tacoma	3,200	9	292
Albany	3,430	10	327
New Orleans	3,430	10	327
Cincinnati	3,183	9	289
Raleigh	3,183	9	289
Total	43,676	125	4,041

Number of men equals 92.5 per 1000 tons.

TORPEDO CRAFT.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
16 Destroyers, Nos. 1-16	7,128	48	1,200
5 Destroyers, Nos. 17-21	3,500	20	415
21 Destroyers, Nos. 22-42	15,582	84	1,722
8 Destroyers, Nos. 43-50	8,000	32	736
Total for 50 destroyers	34,210	184	4,073
Stringham	340	2	55
Farragut	279	2	62
Goldsborough	255	2	61
Bailey	280	2	57
15 Torpedo-boats (154-210 tons)	2,695	30	450
5 Torpedo-boats (142-150 tons)	756	10	120
3 Torpedo-boats (105-120 tons)	330	3	63
5 Torpedo-boats (30-65 tons)	252	5	65
	5,187	56	933
38 Submarines (about)	10,000	38	520
Total torpedo craft	49,397	278	5,526

Number of men equals 112 per 1000 tons.

MONITORS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Cheyenne	3,225	6	209
Ozark	3,225	6	209
Tallahassee	3,225	6	209
Tonopah	3,225	6	209
Monterey	4,084	6	210
Monadnock	3,990	6	210
Total	20,974	36	1,256

Number of men equals 60 per 1000 tons.

TRANSPORTS, ETC.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Columbia	7,350	8	250
Minneapolis	7,350	8	250
Buffalo	6,000	5	171
Celtic	8,000	4	124
Culgoa	6,000	4	123
Glacier	8,325	4	130
Dixie	6,114	6	203
Panther	3,380	5	183
Prairie	6,620	5	172
Rainbow	4,360	5	174
Supply	4,325	5	132
Yosemite	1,197	5	128
Mayflower	3,050	6	166
Solace	5,700	..	112
Relief	3,300	..	55
Eagle	434	3	63
Hist	472	3	58
Scorpion	775	3	80
Sylph	152	1	28
Yankton	975	3	96
Pompey	3,085	3	74
Iris	6,100	3	116
Total	93,064	89	2,888

Number of men equals 31 per 1000 tons.

GUNBOATS.

Name of ship.	Displacement.	Complement.	
		Line officers.	Men.
Annapolis	1,010	6	150
Princeton	1,010	6	150
Newport	1,010	6	150
Vicksburg	1,010	6	150
Nashville	1,371	6	171
Helena	1,392	6	177
Wilmington	1,392	6	177
Marietta	990	6	148
Wheeling	990	6	148
Alert	1,110	6	133
Callao	243	2	29
Elcano	620	4	97
Mindoro	170	2	21
Pampanga	243	2	29
Panay	170	2	21
Paragua	243	2	29
Quiros	350	3	54
Samar	243	2	29
Villalobos	370	3	54
Castine	1,177	6	138
Machias	1,177	6	138
Dolphin	1,486	6	125
Dubuque	1,085	6	154
Paducah	1,085	6	154
Petrel	890	6	131
Ranger	1,261	6	133
Yorktown	1,710	6	175
Bennington	1,710	6	175
Concord	1,710	6	175
Wolverine	685	3	82
Don Juan de Austria	1,130	6	145
Isla de Cuba	1,030	6	137
Isla de Luzon	1,030	6	137
Total	31,103	163	3,916

Number of men equals 126 per 1000 tons.

MISCELLANEOUS.

	No. of men.
Receiving ships (includes Mohican and Baltimore)	1,326
Prison ships and prisons	161
Training ships	517
Navy yards and stations	1,160
Tugs (44 in number)	552
Recruiting	200
	3,916
Fish Commission:	
Albatross (71), Fish Hawk (44)	115
Prisoners	860
Total miscellaneous	4,891

GRAND TOTAL.

(*Ships Serviceable for War Purposes Alone Considered.*)

Class of ships.	Displacement.	Complement.	
		Line officers.	Men.
Battleships	555,796	795	26,417
Armored cruisers	140,080	238	8,058
First and second-class cruisers	69,409	140	4,571
Scout and third-class cruisers	43,676	125	4,041
Torpedo craft	49,397	278	5,526
Monitors	20,974	36	1,256
Gunboats	31,103	163	3,916
Transports, etc.	93,064	89	4,888
Miscellaneous	.....	...	4,891
	1,003,499	1,864	61,564

The Personnel Act of 1899 provides that when at the end of any fiscal year the average vacancies for the fiscal year above the grade of commander have been less than 13, above the grade of lieutenant-commander less than 20, above the grade of lieutenant less than 29, and above the grade of lieutenant (j. g.) less than 40, a board may select out sufficient officers to cause the vacancies above noted. But no more than 5 captains, 4 commanders, 4 lieutenant-commanders and two lieutenants may be selected out in any one year.

From July 1, 1911, to June 30, 1912, there are only five retirements due to age that will cause vacancies. By selection, 15

officers may be selected out. This will give 20 vacancies above the grade of lieutenant (j. g.). If 20 more vacancies do not occur by voluntary retirements, resignations or casualties, the 40 vacancies will not result. The same result will occur in the grades of commander, lieutenant-commander and lieutenant, and the 13, 20 and 29 vacancies above the respective grades will not be obtained. It, therefore, becomes necessary to produce a continuous flow of promotion that will result in younger officers for the higher grades. The Personnel Bill at present before Congress will produce the flow in a manner fair and just to all.

If promotion by selecting out to cause vacancies is not obtained, promotion by selection becomes a necessity and few in the service would welcome such a system with its accompanying evils.

From July 1, 1911, to July 1, 1919, there will be about 53 retirements from age, eliminating extra numbers. This will average just under 7 vacancies per annum due to retirements for age. With 15 retirements due to selection, 22 vacancies per annum above the grade of lieutenant (j. g.) will result. Casualties will not give the remaining 18 vacancies by any means and, therefore, about 30 vacancies, or three-fourths of the vacancies that should be affected, would result. It will be impossible to obtain the 20, 29 and 40 vacancies supposed to result from the Personnel Act of 1899 and consequently those now entering the grades enumerated below will take about 20% longer time to pass through the grades than noted in column "A" below, except in the case of commanders, as 13 vacancies above this grade are practically assured, resulting in passing through this grade in 9 years. Column "A" gives the number of years an officer is supposed to pass through the grade indicated, according to the Act of 1899. In column "B" is noted the time it took the senior in each grade on July 1, 1911, to pass through the grade:

	A	*B*
Commander	9	3.0
Lieutenant-commander	10	5.1
Lieutenant	12	6.0

It is, therefore, apparent that the grade of lieutenant (j. g.) is not the only grade vitally affected. With no personnel legislation, we now have the youngest captains and commanders that we shall have for many years to come and the ages of youngest in grade will rapidly increase.

The Department's present Personnel Bill certainly does remedy evils that are close upon us and should be studied closely by every officer. The bill is not complex, but is long and covers a vast amount of ground. Due to its length it is considered complex, but it becomes simple if carefully considered, section by section. Minor changes are necessary, however, to remove opposition and the bill should be discussed more in order to get the opinions of the service at large. If one is opposed to the bill there must be a reason and by giving reasons a better understanding among all concerned will result very quickly. To condemn a bill on general principles and without stating reasons is not logical.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MESSAGE SIGNALLING IN THE FLEET.

By Lieut.-Commander Richard Drace White,
Late Fleet Signal Officer, Atlantic Fleet.

The question of signalling sometimes reminds me of Mark Twain's remark about the weather. He said that people were always talking about it but nobody ever seemed to do anything about it.

People *are* always talking about signalling. I do not know of any other branch of the fleet's work that is so extensively and freely discussed. I do not know of any other fleet topic that arouses such sympathetic interest—in talk. Nor is the talk insincere. Many officers are thinking hard on the subject and are willing to go to great lengths to help signalling along. And as for doing things, the object of this paper is to show that Mark Twain's remark is not entirely apropos.

However, the road to successful fleet signalling is not altogether strewn with roses. There are some boulders. For example, it is one thing for a division officer to tell you what ought to be in the signal line, and quite another for him to give up his prize loader to the signal bridge; it is one thing to teach a sailor to punch holes with a dotter in a grossly enlarged slow-moving bull's eye, and quite another to get this same horny handed sailor to saying his prayers in semaphore; it is one thing to bring an offender at gun drill to a realizing sense of his error if he slows up a load and quite another to fix up a signal-man some two miles down the line who mangles an innocent sounding message from the commander-in-chief and causes a great deal of trouble thereby.

That efficient signalling is essential to the fleet's efficiency, no one who has been in the fleet can doubt. Much of the administration that would otherwise have to be done by letters and guard mail may be done quite as thoroughly and with greatly increased

facility by signals. Much of it can be done only by signals. And as for comfort, it is impossible to estimate how much can be added to the comfort of those that live in the big ships if an efficient signal (telegraphic) service is maintained. One who has had the long used telephone taken out of his house can, in a measure, comprehend what it means. One who was recently tied up in the ice in the North River with many things happening, and the signal service gone bad also knows what it means. We are prone to appreciate our luxuries only when we have lost them.

There are many things that go to make up efficiency in fleet signalling. Men, material, methods, esprit, bridge discipline, all leave their mark on the output as they do nowhere else in the fleet. It is an ever changing, unstable, flighty, bit of man machinery that must be carefully watched and managed all the time if it is to be made and kept the dependable usable instrument that a proper signal service should be.

First of all, of course, in the making of a signal service is the man on the bridge. That he is difficult to get goes without saying. A specially intelligent, willing, trustworthy man is required. The work is fine to the point of expertness; it is frequently disagreeable since it must be carried on in foul weather as well as fair; it is trying in that it comes in lumps with large spaces of inactivity interspersed; and its proper performance must of necessity rest largely on the esprit of the signalman himself, since the supervision exercised is, as a rule, limited—in fact the supervision actually exercised develops too frequently into the nagging variety, the inevitable result of supervision by many masters. There is not really any live inducement to get men to the bridge. The extra pay of a signalman, is to be sure, three dollars, two, one or nothing depending on his class, but he is practically the only unrated man in the deck force required to stand night watches in port as well as at sea, he is actually at work a great deal of the time when his messmates are free to do as they like, his work is very disagreeable in bad weather during most of which his messmates are under shelter, and he is robbed of many opportunities for advancement that his messmates enjoy. For example, a man on deck, if he has the intelligence, handiness and other good qualities essential in a really good signalman, can, with much less effort than is required of a signalman in the latter's regular routine work, become a gun pointer and get ten dollars extra a month, and once he has obtained

his classification can retain it a year with practically no effort at all. He also stands a better chance of advancement, since his good work is always visible to the division officer, the real governor of his future, whereas the signalman only comes to the attention of his division officer to explain some fault he is supposed to have committed. Naturally the division officer finds it difficult to see anything good in a signalman. As for the rating of quartermaster, the rate always looked to as the logical reward for a signalman, it is more apt to be given to a good helmsman than to a signal bridge man. The inducements, as may be gathered, are meager. Good men are, naturally, hard to get.

Now come to the signal officer. In regard to the battery, the captain shall assign officers to command of gun, powder and torpedo divisions in a manner that will, in his judgment, most conduce to the efficiency of the ship as a whole, and shall make no changes in such assignment except to the same end. As for signalling, he usually assigns as signal officer a midshipman from the last class to join the ship regardless of whether or not he has shown himself capable of handling a difficult situation, removes him or replaces him as circumstances seem to warrant and even goes without a signal officer for long periods at a time, detailing one for the occasion if the signal officer is sent for by the commander-in-chief.

But to go back to the man on the bridge, the question of the detail of men for signal duty is really a serious one. The deck complement of a ship is based on her guns. Enough men, outside the special branches, are allowed the ship to man the guns. Signalmen used to be detailed from men supplied to the ship primarily to man the guns. A certain number of signalmen, to be sure, had no gun stations, but generally speaking the first duty of signalmen was at the guns. There was therefore a certain amount of friction between the signal officer and the division officers as to the employment of these doubly employed men. It was difficult to carry out systematic work on the signal bridge on account of the frequent calls on the signalmen for work at the guns. The good men of the signal force generally occupied important gun stations, and were therefore required to be absent from the bridge a great deal of the time. Furthermore, the employment of these men at the guns left the signal force reduced, when the crew was at battle stations, to less than the force employed on the bridge in ordinary maneuvers and did not in any measure provide for reliefs for casualties

in action among the signalmen actually employed as such. It was therefore proposed (and accomplished after much opposition) to have the complement allow for a certain number of men for signal duty only, to restrict the employment of these men to signal work only, to definitely forbid their being assigned to gun stations or stations other than those devoted to or connected with signalling. This permits of singleness of duty on their part, gives enough men to man in action the stations that are manned in ordinary maneuvers, and provides reliefs for casualties which are sure to come in battle, owing to the exposed positions signalmen must occupy. It was also ordered that the signalmen's ship work should be restricted, except in general evolutions, such as coaling, to work in connection with signalling, cleaning the signal bridge, and looking out for signal gear. This came near being the death blow to the scheme, for the signalman had been the officer of the deck's handy man from time immemorial. He had always been messenger or quartermaster or boatswain's mate when the real occupants of those positions were below drinking coffee. The traditions of the navy appeared to hang in the balance. In this connection, it has always seemed a strange thing to me that, while an officer of the deck would never think of calling a wireless operator away from his desk to go on a message, he will without hesitation take a signalman from the bridge to attend to business that is in no sense his, and which can be done equally well by a dozen other unoccupied men whom he has at his command. Signalmen, as a matter of fact, are probably actually engaged in signalling twice the hours per watch that the wireless operators are in telegraphing. Their work is equally affected by distractions, and yet the consideration shown the two men is radically different. Take the wireless operator. In order that he may not be disturbed in his work, he is closed in by a locked door and an official dead-line. He has removed from his vicinity every annoyance from the boatswain's pipe to the commander-in-chief's band. An orderly is stationed to deliver wireless messages as they come. On the other hand, a signalman is dead lucky if he has a weather screen on a bad day, noise he is supposed to thrive on, and as for running messages, he is not supposed to run, he must fly. One of the most profitable innovations established on the flagship's bridge was the employment of the wireless orderly to deliver signalled messages as well as wireless ones.

The policy of restricting signalmen to signal duty only threaded a tortuous road to success. It meant in the first place, complete reorganization of the signal force of practically every ship in the fleet, for practically all the good men in the signal force were special men at the guns—pointers, captains, loaders or such—and as the guns had first claim, the signal force was for a while almost entirely made up of green men. This situation was to be expected, for the very qualities that make a man a good signalman make him good at his other work, particularly at the guns. Still, the situation resulting from the change was, I must confess, rather shocking. The end, however, justified the means, and once the new gang was got into shape it was luxury to the signal officer compared to what his task had been before.

The recruiting of new men for the signal force to provide for casualties, such as expirations of enlistments and discharge of worthless men from the bridge, is however always a difficult one. Good men are wanted in other places and, whereas there is always some place in division work where a mediocre man may be employed to advantage, there is no such place on the signal bridge. A wise signal officer therefore always has a few likely suspects under his lee whom he may call on in time of trouble. This was arranged for in the flagship by augmenting the signal force during the periods of slack gun drills, such as repair periods at the yard, and sending the extras back to their divisions when the work at the guns began again. In this way men were trained so that in case of need they could be called to the bridge with a minimum resulting confusion.

It has been frequently proposed to have a special signal corps for the navy, such as is provided for the army. I have always doubted the wisdom of such a provision. Many men can never make good signalmen. Others, although they can do so, do not, after they have tried the work, want to make good ones. It is therefore well to have an easy way to be rid of such men. The most salutary punishment that can be inflicted on a member of the signal force is to put him temporarily or permanently off the bridge. This, it is obvious, could not be freely done if signalmen formed a special corps.

The making of a signalman is interesting. Very few men of the gun divisions learn to signal sufficiently well by the signal drills now held to make them of particular value to the signal officer until

they are specially trained. When a new man comes on the bridge he is about as well off if he does not know any signals at all. He will at least learn right when he does learn. Drill has very little to do with a signalman's efficiency. It is work that is needed. New and old alike have to be kept actually signalling practically all the time if they are to be kept efficient. Signalmen never tire of actual work at signals. It is the drill that makes them want to get off the bridge.

But plenty of work is not always to be had. Ships separate and go to the yards. Business gets dull even when the fleet is together. These are the times that the signal officer dreads. Many schemes have been tried to keep the force up and interested. I say interested because, unless the men are interested, a signal drill is worthless as no other drill can be. Signalling in cipher has proved very good, but it is difficult to do enough of that. P. D. L. work on time and accuracy test is good when mistakes and delays are pointed out to the offenders, but that too is difficult to keep going. One scheme that has proved very successful is to use a buzzer something after the fashion practised at the wireless school at the New York Yard. One man is detailed to send while the others, each supplied with pencil and pad, read and record as the message is received. This demands a minimum supervision on the part of the signal officer. A glance at the sheets turned in reveals the progress of each man, and, best of all, it gives a line on men capable of making good recorders. (It is a curious fact that the recorder is almost the most important man in the watch and good recorders are more difficult to develop than good signalmen.) Encouragement along certain lines helps a great deal. If, when signalmen on watch are not actually engaged in signalling with other ships, they can be induced of their own free will to signal to each other, they will be kept in good shape with practically no effort on the part of the signal officer. The practice of permitting signalmen to signal between ships when no work is going on helps no end. It has been employed successfully for several years in the fleet and except for minor friction, usually caused by misunderstanding on the part of some new signalman, no harm has ever come of it. It is practised in all telegraph and cable concerns and is worthy of all encouragement.

One of the most difficult things to contend with is the tendency of signalmen to fall into the exclusive use of one code, to the detri-

ment of efficiency in all other codes. Of course the ideal signal system would employ one code only. Men could easily be made proficient in that. Telegraphers and wireless operators who employ only one code get so they fairly think in the code. It becomes second nature to them. They read in the code as one ordinarily reads print. But it is a condition not a theory that we have to struggle with now, and signalmen must be kept proficient in all.

If signalmen were allowed to choose they would never use anything but the semaphore. In fact until certain precautions were taken in the fleet that was practically all that was used. This does famously while the ships remain in close formation, but when they separate, as when carrying out target practice, the semaphore becomes a complete loss. Signalmen who are expert at short ranges cannot read semaphore messages where wigwag signals can be plainly made out. Then there is of course a great deal of time when only shutter searchlight work is possible. On one occasion the signal force, which had been working faultlessly while the fleet was together, became completely paralyzed upon its separation for target practice. While expert at semaphore work they were quite at a loss at the codes that the situation required to be used. One experience of this kind was enough. Signalmen were required thereafter to transmit regularly a certain part of the work by searchlight, blinker or wigwag regardless of the distance, and little difficulty in this respect was subsequently experienced.

The mere training of men to send and receive signals is, however, only a part of the signal officer's business. The organization, the stopping of errors, the speeding up in order that the work in hand be done, the bridge discipline, the requirement of smartness in order that the spirit may be maintained, are all points that must be kept ever in mind. Team work puts its stamp on signal work as definitely as it does in gunnery. Unless some definite arrangement for interlocking the work is made, a bridge can become a torment of confusion second only to Babel itself. Let a call be seen and the whole watch will, unless curbed, rush into the fray. They will shout back and forth, read the signal each man for himself, completely rob it of all meaning and end in loud impeachment of each other's intelligence. In the meantime any other call that flies is utterly disregarded.

As a matter of fact team work comes naturally on the bridge. The arrangement on the flagship's bridge was to have the watch divided into pairs, one man of each pair to actually signal, the other to record. In sending, the recorder read off the message if necessary. In sending to more than one ship, where several senders had to be employed at once, one man read while three sent. In receiving, one read while the other recorded. The men of each pair always worked together. The calling of a signalman also meant the calling of his recorder. With four signalmen and a quartermaster in the watch two signals could always be received or sent at the same time. And as the chief quartermaster and the relief watch were always called when the work was heavy, it was not unusual to see five messages being handled at once, with practically no confusion.

There is one requirement of an efficient signal service that deserves mention for its oddity, and that is that it get through unfailingly all messages entrusted to its care, or when this is impossible, report the failure to do so. It seems odd that this question should come up at all, but it is surprising how easy it is for signals to simply disappear in transit unless some special means are taken to prevent it; and further how extremely difficult it frequently is to fix the responsibility in such a case. The greatest step towards eradicating this evil is accomplished when signalmen are brought to realize that it is the sender's duty, not merely to send but to see that the receiver understands, and that he must persist in his sending until satisfied that this is done.

To be really efficient the service must also be rapid. A message given to the signal bridge must, as a rule, be sent immediately, otherwise it is better to use the guard mail or send a special boat. It is astonishing how the time required to get signals through mounts up if any laxity in this regard is admitted. Strange as it may seem the rapidity of the code employed has very little to do with this feature of signalling. Occasionally a fast code will get a signal through which would be lost entirely if a slow code were used, but this is exceptional; and as for the ordinary work, the delays in getting the message to the bridge, of getting the next ship's attention, and of getting it delivered at the other end are the things that have most to be struggled with. As to getting the receiving ship's attention it may be put down as an axiom that the best ship at signalling is the one that keeps the best lookout.

The paramount problem of signalling, however, is the necessity for accuracy. Unless it can be confidently assumed that a signal will be delivered without error in practically every instance the signal service comes near being worthless. When you consider the sources from which errors may come in signalling, it is surprising that satisfactory accuracy is ever attained. Compare a message sent by telegram with the ordinary signal. In the first place the man who has the telegram sent is usually paying for the privilege. He is therefore careful to see that no fault of his forbids its getting through correctly. He writes out his messages as legibly as he can. If he is a bad writer he prints it. He puts it on a regular blank, checks his words and gives it to the operator. The operator sits down in an easy chair, in a warm office, with the copy before him, and sends it over the wire. The receiver, also in a comfortable chair, in a comfortable office, reads and records it as it comes. He checks the words, files the message, and sends it out.

The conditions surrounding signalling are different. If so and so wants to send a signal he scribbles it off on whatever is at hand, or he may send an orderly or a mess boy up to say please signal so and so. Maybe he shouts the message up to the bridge from the deck. In this practice alone there is abundant chance of error. As a rule one signalman must read while another sends, another source of error. If the signalman is careless in his manner of making his letters by semaphore there is a fertile chance of error, for the receiver is frequently so anxious to make good that if a man merely waves his arms from one bridge the signalman on the other will get some word out of it. Moreover there are many words that are, naturally, easily confused when sent by semaphore. Many a ship has had to shift berth because northwest and southwest are almost identical when spelled out by semaphore. There was an officer in the fleet whose name almost baffled all efforts to send it by signal. That was Lieutenant Conn. No receiving signalman could be induced to read it anything but Lieutenant Com (the com meaning commander) and growl at the fool on the other bridge that left out the officer's name.

Then take the receiving ship. The man that reads the signal cannot record it himself. He must have another man record for him, another source of error. The recording must be done in all sorts of weather. Frequently proper pads and pencils are not supplied. Often the recorder is not a literary person and his

spelling is not like that of other men. And there are many other sources of error. In fact they are so numerous and so perverse that their stoppage in entirety seems almost hopeless. Still by systematic vigilance a surprising accuracy can be secured, and it is worth working for. The steps taken to secure this accuracy in the fleet are, I believe, worthy of recital.

A checking system was established which, although it appeared elaborate, was systematized into comparative simplicity. It consisted of first adopting a standard signal blank resembling the forms used in the Western Union and Postal Telegraph Offices, and requiring that all signals be inscribed on these forms before they were sent, if practicable. Each ship was required to adhere strictly to the standard form, even in regard to the size to which the form was cut, as any variation hampered the officer charged with the duty of comparing the records of the various ships, a task of considerable difficulty at best. These forms contained, in addition to blank places for the words of the message, places, each in its standard position for, (a) the ship to which the message was sent or from which received, (b) the name of the person addressed, if the message was addressed to any particular person, (c) the date, (d) the time at which the message was acknowledged, (e) the number of words in the message, (f) the name of the officer or petty officer actually in charge of the bridge when the message was handled, and (g) the name of the signalman sending or receiving the message. In addition to this, the name of the ship on which the blank was used was printed in bold type across the top of the form. These forms were kept in pads in officers' messrooms, staterooms, offices and elsewhere, and their use was easily made general. In addition to the regular record it was required that one copy of every message sent or received be filed and forwarded for comparison to the flagship by the first guard mail after the day was completed. Carbons were used whenever practicable to facilitate the making of the extra copy and also to avoid errors of copying.

In sending, the sender himself was required to read off the message whenever practicable and when not practicable to be sure of every word read off to him before it was sent. In receiving, the signalman who actually received the message was required to take the blank from the recorder, read it over, and when satisfied as to its accuracy, to sign it in a space reserved for his signature. This fixed the responsibility for one class of errors that had hitherto been

flagrant. It is curious to note that this practice, instead of being shirked by the signalmen, was thoroughly liked by them. Some feeling of pride or responsibility seemed to be aroused by their overseeing and checking the work of somebody else.

After the receiver had checked and initialed the message it was given to the officer or petty officer in charge of the signal watch who also read over and initialed it, and then, and not until then, was the message ready for delivery. In case the officer in charge of the signal watch found anything improper about the signal or if it appeared to lack sense, he would have the signal repeated. In this way many of the errors were intercepted right on the bridge, for the officer in charge of the watch, knowing what was going on, could frequently detect errors in signals that would not be apparent to one not acquainted with the situation. Having initialed the message the officer in charge of the signal watch would send one copy to its proper destination and file the other to be sent on the succeeding day by guard boat to the flagship for comparison.

When all copies had been received on the flagship they were compared, and the errors noted and brought to the attention of the offending ships. From the data on the blanks the responsibility for error could be placed not only on the ship but on the watch and even on the signalman making the error. A tabular record was kept of the number of errors made by each ship and signalman in the fleet, so that all hands were on a competitive basis all the time. It soon became apparent not only what ships were poor but what signalmen on those ships were causing the weakness.

The employment of this checking system reduced the errors tremendously. The strictest count was kept. Misspelled words although their meaning was apparent were counted as errors. Moreover when a mistake was made it was counted against the sender as well as the receiver. And even with so strict an accounting maintained, there were cases of ships handling several hundred words a day, going for a week with as few as four errors.

The plan of counting errors against the sending as well as the receiving ship met at first with opposition, but it is, in my opinion, to the best interest of signalling, to so count it. In the first place it serves to bear in upon all that the responsibility of the sender does not end with his merely having sent the signal but only with his having made the receiver understand it. In this connection I am

inclined to believe that the majority of errors made are due to faulty sending.

In calculating the errors made by the various ships, efficiency was rated according to the number of mistakes made in handling so many words, not simply the actual number made, for a ship handling a large amount of work will naturally make more mistakes than those handling only a small amount. The fairness of this must be generally acknowledged.

In counting the number of words handled by the various ships frequent surprises developed. Surprises that some ships handled so few words, and that others handled so many. Some ships would run along with a hundred a day. Others would go to a thousand. The record day for the flagship was something near three thousand. There are twenty-four hours in a day, therefore the average was over a hundred words an hour, and as very little signalling is done during the middle of the night there must have been handled during some hours from two to three hundred words. In the three thousand words in question there were eight errors, most of them misspelled words, which shows what can be done.

Generally speaking, the problem of message signalling in the fleet does not differ vastly from the problem that confronts the big telegraph companies of our country. Much may therefore be learned by adopting the methods used by those companies. In any event the aim should be to provide the fleet with as good a telegraphic service as is provided by them for the people at large. Perhaps such a service can never be attained, for the difficulties facing its accomplishment are great; but the service that is can be made surprisingly good. Keep the fleet together, give the signal force plenty of work, remove from the sending of signals the requirement that some special formality be complied with before the privilege becomes active, make the sending of signals as free as the posting of a letter (the two are analogous), demand a quick, accurate, dependable service and it is surprising how quickly the service will respond to the demand.

Altogether signalling in a live fleet is bound to be a big problem. Its very life depends on its being kept big and its proper solution on its being regarded as big. The millenium is, of course, never reached but it can be so nearly approached as to make the signal service of a fleet a splendid asset to the fleet's efficiency and that is all any form of fleet work can properly become.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE DESTRUCTION OF THE LIBERTÉ.

By Lieut.-Commander Ralph Earle, U. S. Navy.

The battleship *Liberté,* 14,868 tons displacement, forming one of the units of the second battleship squadron under the command of Vice-Admiral Bellue, anchored in the harbor of Toulon, was destroyed by fire and explosion on Monday morning, September 25th, 1911.

The weather was beautiful, and the ship had just started to swing to a light breeze on starboard bow. Soon after reveille had sounded, and while the crew were scrubbing clothes on deck, a noise, as of escaping steam, was heard together with a heavy sound or rumbling. This was at 5.17, and yellow acrid smoke with a powder smell issuing by way of the ammunition hoists and ventilation pipes from the starboard forward 7".6 magazines was quickly followed by blue and then yellow jets of flame. These flames with thick and suffocating smoke filled the ship rapidly. The crew went to fire quarters quickly, Lieutenant Bignon in charge, and unsuccessful efforts were made to flood the magazines. The men endeavoring to do this were driven from forward by this heavy yellow acrid smoke. Possibly also the intense heat of the fire had bent the operating gears of the flood valves.

The chief engineer, Lestin, in obeying a second order to flood the forward magazines, saying, " I've already tried," started forward again but never returned. About 5.27 to 5.35—time variously estimated within these limits—an explosion occurred under the foremast sending up a thick column of smoke followed by flames; three other explosions followed at intervals, the first putting out all the lights on board, thus adding to the difficulty of controlling events. Assistance was signalled for and sent promptly by the other vessels of the squadron.

Lieutenant Garnier took charge about this time, and, the flames seemingly subsiding, countermanded an order of Lieutenant Bignon to flood the central and after magazines, until he could learn more definitely the exact condition of affairs, and to quiet the growing panic.

The interior of the hull was burning, and from time to time jets of flame shot out of the foremast, these being caused by the explosion of boxes of 9 and 3 pounder ammunition.

The call to quarters was sounded, and the crew went to their stations bravely, and even those who had jumped overboard in the first panic endeavored to reboard the ship to return to their stations. Water could not be obtained in sufficient quantity in fire hoses, the attempts to flood forward magazines were failures, the whole inside of the ship was a furnace in which were burning all sorts of combustible material, bags, hammocks, linoleum, etc., and a thick smoke penetrated everywhere. The order was given to flood the amidship magazines, but the smoke and darkness rendered this impossible of accomplishment. The temperature between decks rose rapidly. The order at last was given to abandon ship. Then at 5.53, *i. e.,* just twenty minutes after the first explosion, came the final and tremendous explosion which converted the *Liberté* into a mass of shapeless and half-sunken débris. The roadstead was covered with wreckage and the maelstrom caused by the explosion swallowed up many boats sent by other vessels to the rescue. This explosion was heard for over thirty miles.

From the testimony of Says, an artificer, who escaped miraculously, we learn that at the moment of this explosion, Lestin, and master machinists Champilly and Steiner, the latter wounded and covered with blood, refusing to save themselves, were on the berth deck struggling with the locks of the flood valves to the amidship magazines. Surely this was heroism of the highest type.

Débris was hurled in all directions, causing damage and death to other vessels of the squadron and to the rescuers.

The *République* was struck by a mass of armour, weighing several tons, about fifty feet forward of the stern, her plates were stove in and ripped off for a distance of twenty to thirty feet, and half-way down to the water line. The *Liberté's* forebridge and two 12″ shells landed also on the *République*. The damage to her was so great that she was docked as soon as possible.

The *Démocratic* was the next heaviest sufferer. In addition to the above two vessels, the following sustained damage and loss of life: *Vérité, Justice, Jules Ferry, Michelet, Foudre, St. Louis, Carnot, Marsellaise* and *Edgar Quinet.*

The final official figures as to the loss of life on the *Liberté* and the above mentioned vessels are:

204 killed or missing
136 wounded, and
48 slightly injured.

The decks, including two 7″.6 turrets, of the *Liberté* from abaft her forward boiler rooms and turrets were blown upward, backward, and doubled up on the quarter-deck of the vessel. The forward part containing the two forward funnels has disappeared. The vessel is now simply a mass of twisted and entangled plates, and together with detached fragments renders navigation in the roadstead of Toulon very hazardous.

CAUSE OF THE DISASTER.

A committee, headed by Rear-Admiral Gaschard, made a thorough inquiry, and, despite the ugly rumors as to socialism and malevolence have reported as follows:

(1) That there was no trace of malevolence.

(2) That the supposition that a fire either in magazines or in adjacent parts of the ship started decomposition of powder is disproved; and that

(3) The spontaneous ignition of a charge in the forward starboard upper 7″.6 magazine was the source of the disaster; and

(4) No blame is to be attached to officers or crew, all regulations having been complied with.

The conclusions of this committee in general are:

(1) The burning of the powder, which twenty minutes later exploded the shells, and transformed the *Liberté* into a terrible wreck, started in a 7″.6 magazine and not in the 9 or 3 pounder magazine.

(2) That in this 7″.6 magazine there were *no* exercise, *i. e.*, target practice, powders, all such having been expended at the previous target practice. The gunnery officer of the *Liberté* is very positive on this point.

(3) That the oldest B powder in this magazine dated only 1906, and that the other lots of B powder were of dates, 1907, 1908, 1909

and 1910. All these lots carried the same mark, $BM_{15}AM_8$ (amyl alcohol as solvent, 8%).

(4) That, therefore, the oldest B powder to which the explosion can be attributed was aged but five years; and

(5) That, by deduction, powders of the B type, five or more years old, can spontaneously ignite.

The powder in question was made at the Pont de Buis factory in 1906. As this lot of powder was looked upon as absolutely reliable, considerable uneasiness has naturally been caused in France by these conclusions. The fact that use of amyl alcohol in manufacture has been abandoned recently leaves a possibility that the powder made in recent years and now in service, will not thus prove unreliable. That its use was deleterious, however, is by no means a point that is agreed upon by chemists.

The destruction of the *Liberté* was thus started by the spontaneous decomposition of a charge of 7".6 ammunition. This set fire probably to the woodwork of the magazine, and the heat caused other charges to explode, not as a detonation, but as a blast furnace or escaping steam, thus adding to the heat in the magazine, and finally causing the melinite shells to burst. The bursting of shells loaded with melinite caused the destruction of the vessel. In the forward magazine there were 142 semi-armor piercing and 101 armor piercing 7".6 melinite shells. In the amidship magazine there were 388 melinite and 104 black a. p., and s. a. p. 7".6 shells. There is some doubt as to whether the shells of the forward magazine exploded, as the damage done to the ship seemingly indicates that the heavy explosion which destroyed the ship occurred in the amidship magazine.

RESULTS OF THE DISASTER.

M. Delcassé, Minister of Marine, has ordered that, hereafter, 4 years is to be considered the limit of age for B powders considered suitable for aboard ship, and this limitation will likely be extended to magazines on shore. This is an expensive step, but, in the uncertainty which at present exists, it seems a wise one.

The monopoly held by "Les Poudres et Salpêtres" has been broken and placed under control.

Naval officers will, in future, control and inspect the manufacture of powder.

The capacity of the factories of "Les Poudres et Salpêtres" has been ordered largely increased, and is now turning out 3000 tons of B powder with diplenylamine used as a stabilizer in place of the now-apparently discredited amyl alcohol.

The factories controlled by the Bureau of Poudres et Salpêtres were held to be guilty of:

(1) Bad workmanship, particularly as to the purity of the raw materials used, the purification of its nitrocellulose, and thoroughness of carrying out the various steps in manufacture.

(2) Slow and costly manufacture; some fifty-five cents per pound avoirdupois.

(3) Deceiving its customers; *i. e.,* the naval officers.

(4) Refusing to experiment with and improve its product.

(5) Sticking to one standard routine.

As a result of the *Iéna* explosion, black and brown powders were separately stored from B powders; additional inspections were provided also. The temperatures permissible for magazines were gradually reduced from 40° C. (104° F.), to 35° C. (95° F.), then 32° C. (89.6° F.), and now 25° C. (77° F.) is to be the limit. This does not appear to be the result of any sound reasoning or experiments however. During recent naval manoeuvers temperatures over 30° C. or 86° F. were continually registered, showing the comparative inefficiency of the isolating system between magazines adopted for the *Patrie* class after the *Iéna* disaster.

The cooling and flooding appliances on board all fighting vessels have been minutely investigated, and tested and practical means to improve them are to be adopted without delay. A few constructors are to be sent to the English fleet to study methods there. It is said that the arrangements for flooding magazines were so unpractical that, even were they in good order on the *Liberté,* they would have been powerless to save that ship in case of spontaneous decomposition. They are called "a challenge to common sense" by naval officers. In case of *St. Louis* class of French battleships, 30 minutes are required to flood the after 12″ magazines. The water is brought to the lower level and not to the top of the magazines.

A committee of eminent specialists has been formed to examine what practical steps it is desirable to take in order to improve the stability and quality of the B powder, and to consider the question of modifying its composition.

GENERAL NOTES ON THE SUBJECT.

Attention is called by many to the similarity in the phenomena of the *Iéna* and *Liberté* explosions. To quote liberally from La Vie Maritime.

" Thus it was on the *Iéna* following the small explosions of the cartridges, as they took fire one after another, came dark and thick smoke with intense heat forming an unquenchable fire, and *twenty* minutes later, the walls of the magazine having become red hot, the shells exploded. This was reproduced in the experiment at Gavres. Twenty minutes after the cartridges of B powder had been lighted, the shells started to explode. The ordnance experts witnessing this could not repress their astonishment.

And now this is exactly what happened on the *Liberté,* the fire starting spontaneously in a 7".6 cartridge. The phenomena were precisely the same in the three cases."

" M. Maissin, who has succeeded M. Louppe at the Pont du Buis factory, states he was surprised to see the disorganized condition of that factory. When there were signs of B powder decomposing it was sent back to the factory to be reworked—steeped in amyl alcohol until it contained 8%—and it was then to be put in special cases to be used at target practice. This, however, was customarily sent out as new, and not as reworked. As the powder which blew up the *Liberté* was sent from the Pont du Buis factory, it might now prove that although designated as 1906, it was many years older, and, as certain data on the duration of stability of reworked powder are not as yet available, the probable life of such powder could not be predicted.

This disaster has been been made the opportunity by many papers, at home and abroad, of an attack on our—United States—powders. Even the disaster to the *Maine* is quoted, though she had not one pound of smokeless powder on board, the *Mikasa,* also, though her explosion was admittedly caused by a fire which originated outside the magazines. The arguments as to the unwisdom of our using nitrocellulose powders have all been answered satisfactorily by our Ordnance Bureau to the most persistent doubter, however prejudiced he may be.

The following few notes may show further where some of the differences between French and United States powders occur, and why our powders are vastly more stable.

B powder is composed of two kinds of nitrocellulose, soluble and insoluble, of 11.60 and 13.23% nitration, respectively. Amyl alcohol was until very recently the solvent. The use of this has recently been the object of much adverse criticism, though the claim has always been made that its introduction doubled the life of the powder. The French have now given it up for the ethyl alcohol, and diphenylamine is used as a stabilizer.

The nitrocellulose is manufactured at one factory, the powder at another, a practice we have given up years ago as unreliable. The required stability test of nitrocellulose with potassium iodide starch paper at 65.5° C. is but 20 minutes. A very faulty purification could easily give this, and inspectors easily be hoodwinked.

The powder is made in ribbon form, and the variation in its ballistic qualities is made by variation in the percentages of the soluble and insoluble nitrocellulose in its composition, and not by varying the web thickness.

The processes used in French manufacture differ radically from those of the United States, particularly as regards attention to detail and thoroughness of purification in all the various steps. The stability of any nitrocellulose powder is absolutely dependent on the quality of the raw materials and on the thoroughness with which the details and purification processes are carried out step by step in its manufacture. The French process of drying is complicated, and includes water drying, which was abandoned, after experimentation, in the United States as injurious to the stability of the material. It seems strange that powder manufactured in the country of its inventor should not be as stable as a similar production of another nation, but such appears to be the fact.

There is in France at this time also a general complaint relative to the keeping qualities of sporting powders, the defects of which are attributed entirely to *careless* manufacture.

Thus we see that the stability of French nitrocellulose powders cannot be considered in the same light as ours. Over ten years ago stringent regulations were prepared by our powder board, it detailing exactly what purification must be given to our materials, and then to our powder in all its various processes of manufacture. These have been the cause of the high stability of our powders. It is seen that in France no one connected with the navy inspected the processes of manufacture, which inspection is here most thorough. In the majority of cases our powders are still stable

after twelve years, and cases of spontaneous decomposition are practically unknown.

The damage to the *Iéna* was caused by the explosion of a large bulk of black powder set off by the fire caused by the spontaneous ignition of a cartridge of B powder, while that to the *Liberté* is due to the explosion of shells overheated by fire started on board by ignition of similar powder.

In the French service shells are stowed in the same compartment with the charges, and not separately as with us.

The danger due to the spontaneous decomposition of our powder is this, and only this, that it will set fire to the woodwork, fixed ammunition boxes, supports of tanks, bins, etc., now existing in our magazines, and thus start a fire which might rapidly become uncontrollable, heating our shells in adjacent rooms to the bursting point. Remove the woodwork and combustible material from our magazines and a disaster like that to the *Liberté* will be impossible in our service.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CHEAPER PAINT FOR THE NAVY.

By Naval Constructor Henry Williams, U. S. Navy.

"Everywhere the paint and shellac was of excessive thickness, in places being more than one quarter of an inch thick."—*Recent report of inspection of a naval vessel.*

Paint materials form one of the most important classes of naval supplies, and their use has contributed to many officers' reputations for efficiency through the aid they lend in making a "smart ship." There was at one time a general understanding in the British navy, reflected somewhat in ours, that no officer could aspire to the command of a first class man-of-war who, as executive officer of a similar ship, had not kept a "smart ship." This included the liberal and proper use of paint, provided often at the officer's own expense.

In these days military efficiency is the main consideration in estimating an officer's value and paint materials cannot be considered as affecting this, other than indirectly. On the other hand, economy is being urged on all sides, and the proper and economical use of paints generally has not been given serious consideration, at least not until recently.

In order that the importance of the subject from this point of view may be judged, the value of the purchases for the year 1910 of the more important paint materials is given:

White lead	$125,000
White zinc	80,000
Red lead	50,000
Linseed oil	100,000
Japan drier	17,000
Turpentine	70,000
Shellac	135,000
Alcohol	49,000

These figures though only approximate will serve to show the relative importance from a monetary point of view of the various

materials, and also justify the statement that the navy's annual bill for painting, including the cost of labor, is not far from one million dollars.

The author has had occasion frequently to discuss the subject of paint for the navy with paint manufacturers and chemists, men who are familiar with conditions as they exist in the trade. These gentlemen, with few exceptions, have stated their opinion that the navy's practice in the purchase and use of paint is extravagant and not justified by the requirements, that equally good results could be obtained with much cheaper materials and good enough results could be obtained with still cheaper materials.

The paint and varnish industry has advanced more within the last ten years than it had advanced in the previous three centuries. It is probable that the navy has not shared fully in the benefits due to this advance and the attitude generally adopted toward any changes in existing methods is one of conservative resistance, due frequently to lack of interest.

READY MIXED PAINTS.

Up to recently practically no use was made of ready mixed paints in the navy; the raw materials were issued and mixed on board ship when required for application. Early in 1911 a change was instituted by which paints mixed ready for use are issued to naval vessels in place of the raw materials. This change is in line with commercial practice, as nearly all the large manufacturing concerns and railroads issue and indeed purchase their paints ready for application. The sale of mixed paints in the United States is said to exceed sixty million gallons annually.

It is a well established and generally admitted fact that a compound paint composed of two or more pigments is far more durable than paint made of one pigment only, and that the intelligent combination of several raw materials produces the best results. Furthermore, the mixing of paint on board ship could not be done as effectively, with no paint mixing machinery or other appliances, as in the navy yards, which have power mills and mixers of the most modern types. Another advantage, and an important one, that is offered by the issue of ready mixed paints, is the facility it affords for the use of newer paint materials, which are gaining ground commercially, and which the navy should use, if it is to avoid the deserved accusation of extravagance and of being

backward in such matters. This important part of the subject will be discussed more fully in another place.

In order that a discussion of painting materials may be profitable it seems appropriate to state the characteristics and limitations of the more important of the paint materials now commonly utilized in the navy.

WHITE LEAD.

This is the white pigment most generally used and it enjoys a well deserved popularity among painters. For two thousand years white lead was the only white pigment used. The process by which it is manufactured most generally, known as the old Dutch process, has been in use practically unchanged for centuries, a description of it being found in Pliny's writings. It consists essentially of a slow corrosion of buckles of metallic lead in earthenware pots which contain acetic acid and tanbark. Carbonic acid is liberated from the tanbark and acting on the lead converts it into a hydrated carbonate of lead. White lead when mixed for painting purposes combines with the linseed oil, forming an unctuous substance known as "lead soap." This accounts, in a measure, for the popularity of white lead with the practical painter, who by the feel of the paint on his brush and the ease of application readily determines whether it has been made with white lead, or with "adulterants." It is a fact generally admitted that a paint made with white lead alone is not so durable as when white zinc, or even when the so-called "fillers," such as barium sulphate, silica, or similar materials are added.

For naval purposes white lead has one serious defect in its susceptibility to the action of sulphur gases. Who on board ship has not seen freshly applied white paint turn black, due to this cause? Generally for this reason the last coat of white paint to be applied to interiors of ships consists exclusively of white zinc.

WHITE ZINC.

White zinc or zinc oxide as a paint pigment is about sixty years old and in that time has gained a well deserved popularity. It is produced by heating metallic zinc in retorts until it vaporizes. In this condition it is passed into chambers where it oxidizes and falls as a white impalpable powder. One of the by-products is the zinc dust which is used in the manufacture of the Norfolk Shipbottom Paint. White zinc is graded according to whiteness

The whitest is known as "French process" white zinc; that not so white is the "American process," which now is purchased almost exclusively for naval purposes. White zinc requires much more linseed oil to make a proper paint than does white lead. It dries with a hard brittle vitreous surface, in contrast to white lead which produces a chalky surface. Also, in further contrast, white zinc is very fine and white lead is rather coarse, so that in mixtures the interstices between the white lead particles are filled in by those of the white zinc. Owing to the different effects of the two pigments, mixtures of them are very popular in paints, and in the navy are generally used. Paints made with a mixture of the two pigments undoubtedly are more efficient than those made with either one alone. Similarly white zinc is mixed profitably with barium sulphate, silica, or other like substances and paints made from these ingredients have been used recently in the navy with good results.

Zinc oxide requires a far greater proportion of linseed oil to make paint than does white lead, and this consideration must not be lost sight of in view of the prevailing high cost of linseed oil.

RED LEAD.

Red lead is the oldest of the protective paint pigments and in this respect it is analogous to white lead. For many years no better paint for the purpose was known and at the present time it is used very extensively and well thought of, especially among sea-going men. It is made from metallic lead by heating, first to produce litharge (PbO), and then to produce red lead or orange mineral (Pb_3O_4). When mixed with linseed oil to make paint it acts very much like plaster of paris or cement when mixed with water. The red lead gives off sufficient oxygen to harden the linseed oil and the paint becomes hard and unfit for use. For this reason no pure red lead paints come ready for use. By the admixture of china clay, silica, or similar inert pigments, this hardening action is prevented. A very satisfactory red lead paint is made with the following ingredients:

65 lbs. dry red lead.
10 lbs. dry silica.
10 lbs. dry china clay.
1 lb. drier.
1 lb. turpentine substitute.
20 lbs. linseed oil, raw.

Paint made in this way is probably more efficient than if made with red lead only and will keep without hardening.

Red lead is used on board ship for many purposes for which it is absolutely unsuited and where paint costing less than half as much would give better service. These locations are coal bunkers, double bottoms, trimming tanks, and bilges. The difficulty that is encountered on the average ship in keeping the metal on these locations painted furnishes abundant proof that red lead is not suitable. It is a safe rule to follow that red lead is efficacious only for use as a priming coat, where other kinds of paint are applied over it and in locations where the metal can be rendered absolutely dry before painting. This refers especially to moisture that condenses on the metal in such spaces as double bottoms. Red lead is acted on with ease by sulphur gases when unprotected by another paint. It requires about 33 pounds of red lead to mix with a gallon of linseed oil, so that the cost per gallon of red lead paint is something over $2.00. It is difficult to get painters to apply it properly, due to its weight and the fatigue resulting from handling the paint brush heavy with paint. For that reason there is a tendency to dilute it unduly. Some grades of red lead are coarse and crystalline, and are not so efficient as the finely divided varieties. For this reason one of the laboratory tests is an examination of red lead under the microscope in comparison with a standard sample.

SHELLAC.

The United States navy is probably the largest single consumer of shellac, of which about half a million pounds are purchased annually and used largely to make varnish for linoleum covered decks of ships. Recently considerable quantities have been used in making ship's bottom paint.

Shellac gum, unlike other varnish gums, is not a fossil but is an annual crop. It is obtained from the secretion of innumerable small bugs which feed on the leaves of a bush growing in India and Siam. The secretion, which hardens, is called "stick-lac" and is collected by natives who take it to the factories, where it is ground, sifted, washed and winnowed and afterwards heated and spread into thin sheets to form the gum shellac of commerce. It is adulterated frequently with ordinary rosin, of which large quantities are shipped to India for the purpose.

As noted above the principal use to which shellac is put in the navy is the manufacture of varnish for linoleum covered decks. For this purpose it is dissolved in alcohol and a pigment, either Venetian red or yellow ochre, added to give it color and some body. On the average ship large areas of linoleum are "shellacked" each week. In spite of arguments that have been advanced that this course is necessary for sanitary reasons, there seems to be no reasonable doubt that it is mainly for appearance sake. Consideration leads to the conclusion that the cost of this luxury, which goes annually over $75,000, is hardly justified, and when the deleterious effect on the linoleum that must be exerted by the alcohol in the shellac is considered, it is a matter of wonder that the custom has continued to prevail so long. Linoleum consists of ground cork held together by a binder of oxidized linseed oil and varnish gums. A small piece of linoleum soaked in alcohol over night shows clearly the effect of the alcohol in dissolving the binder, leaving the ground cork without cohesion. The cost of providing and fitting linoleum to the decks is about $1.50 per square yard, as much as the average householder pays for his carpets. Other materials, such as ordinary floor wax, could be used for polishing the surface of the linoleum and the requirement for appearance could be met at much less cost than at present, without sacrificing to any extent the much abused consideration of "sanitary conditions."

LINSEED OIL.

Linseed oil was the only oil medium for paint for many years, and is the only one at the present time used in the navy. It is made by expressing the seeds of the flax plant, after they have been ground and heated. It has the property of combining with oxygen and, when applied in a film, of hardening into a tough covering for the surface to which applied. When heated to a temperature of 300° F. to 500° F., it acquires an added facility for oxidizing or drying. This is boiled linseed oil. Very much the same effect is obtained by adding so-called driers, made usually with the oxides of lead and manganese. These supply oxygen to the oil, which in turn they regain from the air. Such boiled linseed oil is called "Bunghole" oil, and is the boiled oil of commerce. Boiled linseed oil has a decided advantage for use in closed spaces on ships due to its facility of drying. It is not issued generally to ships of the navy, the required effect being obtained through the use of driers in the paint.

Due to an unprecedented condition in the linseed oil market the price has tripled in recent years. The paint industry is the only one that adheres to the use of linseed oil, although there are substitutes that promise well and undoubtedly can be developed to take its place in part if not entirely. The most important of these substitutes is fish oil, which is made from menhaden and now can be produced without the disagreeable odor that marked it formerly, at about half the price of linseed oil. Experiments made with fish oil for paints for naval purposes promise well and its use to a certain extent is likely.

There is no justification for the disposition of many to consider fish oil or similar materials as adulterants, and many manufacturers of oil cloths, patent leathers and imitation rubber fabrics have found that, when properly treated, it is superior to linseed oil. It can be treated so as to withstand the action of high heat and for this reason is valuable for smokestack paint. Dr. Maximilian Toch is authority for the statement that the addition of fish oil with suitable drier renders paint more durable to sea air and corrects the chalking tendency of white lead and the hard drying quality of white zinc.

It is probable that fish oil and other oils are destined to supplant to a considerable extent linseed oil for painting, as the conditions that have led up to the scarcity and consequent high price of flax seed are not likely to be relieved.

China wood oil, or Tung oil as it is called also, can not be regarded as a substitute for linseed oil, except for certain special uses. Linseed oil films have not the property of excluding moisture and for that reason linseed oil paints will not stand well in damp locations. Paints made with Tung oil have the quality of being water-proof and its use in damp-proof paints is general for that reason. Tung oil is difficult of manipulation and to obtain good results considerable skill is necessary. In spite of this, however, its use is becoming general, not only in paint above mentioned, but also in varnishes. Dr. Toch is authority for the statement that a better varnish can be made out of Tung oil and rosin than out of higher grade gums and linseed oil.

Soya bean oil and corn oil are used for mixing with linseed oil. It has been stated on good authority that as much as 20 per cent of them can be mixed with linseed oil without affecting the properties of the latter, except as to drying.

TURPENTINE.

Turpentine has been used for many generations as a solvent for paints and varnishes. It is manufactured from the sap of several species of pine trees, by distilling with steam. Due to the destructive methods employed in gathering turpentine the supply has decreased enormously in recent years, and the price has increased correspondingly. Unless these methods are interfered with, it is likely that in the lifetime of the present generation turpentine will become a chemical curiosity. It is used to mix with paints as a diluent or extender, its function is mechanical, being simply to increase the spreading power and working quality of the paint. It evaporates leaving no residue, so it cannot be said that it contributes except indirectly to the life or quality of the paint film. It is generally admitted now that entirely too much stress is laid upon the value of turpentine as a paint vehicle, and when this is realized, substitutes will be used that serve the purpose quite as well and in many cases better than turpentine itself.

Due to the scarcity of sap turpentine, of recent years so-called wood turpentine has been manufactured extensively. This is made by the distillation in retorts of sawdust, shavings, old logs and roots of pine trees. The quality of these turpentines depends upon the method and care used in their manufacture, many of them being the equals in every respect, except possibly as to odor, of the sap turpentine. Others have very disagreeable odors and injurious properties due to the products formed in the destructive distillation of the wood. For exterior painting these wood turpentines generally are quite as efficient as the sap turpentine. For interior painting their odor in most cases condemns them. In general they cannot be said to have any advantage over benzine products, which are supplied for the same purposes.

The navy department purchased in the year 1910 about 75,000 gallons of turpentine under specifications that required delivery of the highest grade of sap turpentine that it is possible to obtain, and consequently at prices somewhat higher than the market. This turpentine was used by the navy for paints of the sort in which manufacturers of ready mixed paints would not consider using other than benzine products as solvents. Consideration of these facts led to the decision early in 1911 to discontinue the purchase of sap turpentines except for special purposes and to purchase for general use in paints a turpentine substitute which

had been shown by test to meet all practical requirements. This material is a petroleum product similar to benzine, but with higher flash point. It evaporates at a temperature of 212° F. with no residue. The use of the material has met with some opposition in the navy, reports have been submitted as to its unsatisfactory qualities. It should be borne in mind, however, that it is a commercial product used very extensively commercially for the same purposes as the navy uses it, and any failure consequently should be considered rather as the fault of the persons using it than of the material. It is likely also that failures due to other causes are attributed to the use of the turpentine substitute. A conservative estimate of the saving to the navy resulting from the use of turpentine substitute is $30,000 annually. One of the objections advanced frequently and with effect against petroleum thinners is the belief that they have a tendency to cause white paints to turn yellow. That this is true is doubtful. The author has never been able to understand that very white paint should be necessary on board ship, and in discussing the matter with expert house decorators finds that from artistic considerations they favor a cream or light yellow rather than dead white. This tint permits the use of more suitable varnish in the gloss paint, as will be pointed out further along.

IRON OXIDE PAINTS.

Large quantities of venetian red are purchased in the navy for coloring the shellac varnish used on linoleum decks. It consists largely of calcium sulphate or gypsum, the remainder being about 30 per cent of iron oxide. One of the most durable of the proprietary metal paints tested at the Brooklyn Navy Yard has a pigment consisting of venetian red.

Indian red is a natural oxide of iron, practically pure, and is used as a coloring matter in the Norfolk anti-fouling ship-bottom paint, in order that it may be distinguished readily from the anti-corrosive.

Metallic brown is another oxide of iron—the best grades being the natural ones. It is used very extensively commercially on steel with success and is considered to be one of the standard protective paints, many persons thinking it the equal of red lead for this purpose.

BLACK PAINTS.

There are many forms of black paint pigments, all of them practically pure carbon, though they differ in structure and qualities. The one most commonly used in the navy is lamp-black, which is made by the combustion of oils. It has remarkable tinting strength and the outside paint now used on ships owes its slate color to the addition of lamp-black, the base being of practically the same constituents as the white paint used formerly.

There are a number of graphite pigments, all of them being nearly pure carbon; alone they form an unsatisfactory paint pigment, but added to other heavier bases graphite pigments have great merit.

RED PAINTS.

For many years quantities of English vermilion paint were used on naval vessels for painting the inside of ventilator cowls. There is no doubt that this added considerably to the smart appearance of the ships in contrast to the white hulls and salmon-colored top sides.

English vermilion is a sulphide of mercury and has the defect of hardening when mixed with oil and kept. The purchase of English vermilion for the navy was abandoned a number of years ago, in line with commercial practice, in favor of the so-called artificial vermilion. This is cheaper, less likely to change color and can be kept mixed ready for use. The particular pigment used in the navy is a lead-barium lake of the azo dye, known commercially as "Lithol."

Red, as well as green, yellow and blue paints, do not have the same importance in the navy as was the case formerly, due to the adoption of the slate color for exteriors of ships. Their use is confined almost exclusively to painting the distinguishing striping on piping on board ships.

BITUMASTIC PAINTS.

Specifications for recent battleships require that the builders, in lieu of the red lead and other paints usually required for these localities, shall apply to coal bunkers, trimming tanks, reserve-feed water tanks, inner bottoms in machinery spaces, and bulkheads and foundations in machinery spaces to height of floor plates, the so-called bitumastic paints or their equivalents. These materials are supplied by several firms under different names, all

of them being of similar composition and characteristics. A discussion of them seems proper, as they promise to play an important part in future painting of the spaces mentioned above, which in the past on naval vessels have been a source of considerable worry to the officer responsible for their up-keep. Coal-tar products deteriorate when exposed to light and for that reason these materials can be applied only in confined spaces. Formulas are given for their manufacture which have been determined tentatively and, while they should not be regarded as final, they will serve to indicate the character and general ingredients of the materials.

The first coat to be applied in all cases is the so-called "solution," which may be made by melting 100 lbs. of coal-tar pitch and 50 lbs. of Trinidad asphalt. When liquid the mixture is removed from the fire and cooled and thinners added consisting of 65 lbs. of coal-tar naphtha and 15 lbs. of mineral oil.

The "enamel" may be made by melting 330 lbs. of coal-tar pitch and 350 lbs. of Trinidad asphalt together and boiling for about three hours.

The "cement" may be made by melting 150 lbs. of coal-tar pitch and 120 lbs. of Trinidad asphalt together and boiling for about three hours, when 150 lbs. of Portland cement is added and stirred in.

In all of these care is required in the heating, the quality of the material is dependent entirely on the manner in which this is accomplished.

The "solution" is applied first in all cases and does not require to be heated, but is brushed on cold. In some spaces the other materials are unnecessary, though it is best generally to follow up the solution with the enamel or cement, both of which must be heated to apply. The former goes on in thickness of about 1/16", the latter about ½". The cement is applied only to the bilges in the machinery spaces, and in the firerooms frequently it is protected by a covering of Portland cement.

These materials have been tried to a limited extent on naval vessels, but have been used extensively on merchant ships for many years. The author inspected, in 1904, the American Line *St. Louis,* which had had the bitumastic materials applied at the time of building in 1894-1895 to trimming tanks, chain lockers, double bottoms, coal bunkers and inner bottoms. The original material was in good condition and had received only minor

repairs. The metal underneath generally showed no signs of corrosion and in many cases the hammer marks around rivet heads could be seen when the bitumastic was removed.

THE SO-CALLED "INERT FILLERS."

For many years white lead, white zinc, linseed oil and turpentine have been regarded as the standard ingredients of which any paint should be made. Many manufacturers quietly utilized other materials that gave results quite as good, but the consuming public cared mainly about the results and had no means of determining the ingredients. A general tendency grew up to regard as adulterants many other pigments than the above that have excellent qualities to recommend them as paint ingredients. Among these may be mentioned lithopone, blanc fixe, barytes, whiting, gypsum, china clay and silica. Some years ago a number of states passed the "pure paint laws" that required, in effect, labelling packages of paint with a statement of the contents. This precipitated the situation, in which many manufactures find themselves, of being forced to justify their use of materials that have given satisfactory results, but which they have used unheralded and which they have permitted the public to be taught to consider as adulterants. An effective campaign now is being waged to show that all of these materials have their function when used in the proper proportions in paints, though their unskilled use perhaps may not give as satisfactory results as older and better known pigments. It was demonstrated by actual exposure tests at the seashore that paint in which the much-despised barytes was a principal pigment gave as good results as one made up with only white lead and white zinc. Many of the numerous kinds of paints used by the agricultural implement trade are made largely from barytes and the results obtained from these should be a sufficient lesson to the navy that its paint money could be spent to better advantage than in the exclusive purchase of lead and zinc paints.

Lithopone is a remarkably fine white pigment consisting of about 70% of barium sulphate and 30% of zinc sulphide. It has achieved great vogue recently for use in the flat wall finishes, which promise to supplant wall paper to a large extent, due to their sanitary properties and durability. It is not suitable, however, for outside paint.

Blanc fixe is barium sulphate artificially produced and is superior to barytes in its fineness and texture. It has many qualities to

recommend it for naval purposes and experiments looking to its use have been undertaken, with excellent practical results. Slate-color paint for outside of ships made according to the following formula has given excellent results in preliminary tests:

450	lbs. blanc fixe, dry.
70	lbs. French ochre, dry.
467	lbs. white zinc, dry.
93	lbs. graphite in oil.
3	lbs. lamp black in oil.
93	gal. raw linseed oil.
12	gal. oil drier.
8¾	gal. turpentine substitute.
2	gal. benzine.

Barytes is well known as the white mineral barium sulphate. Used alone it has little covering power, but when mixed with white zinz or white lead it gives excellent results. Consideration shows that it would not be unreasonable to expect it to show durability as a paint pigment, as it is one of the most permanent of the minerals and is absolutely insoluble in most solvents. Due to its density and crystalline structure, barytes has not large covering or hiding power, and needs to be mixed with other pigments to form satisfactory paint.

Whiting, or calcium carbonate, is used mainly for making putty, but small percentages are used by many manufacturers in all paints for the purpose of neutralizing any acidity that may develop. This feature of whiting recommends it highly for paints for steel surfaces.

Gypsum, or calcium sulphate, is the main ingredient of venetian red, of which large quantities are used by the navy; the remainder being ferric oxide. In its pure state it is used to advantage if free from lime.

China clay is used mainly as a filler for paper, but has considerable value in paint mixtures, its addition being an improvement to red-lead paint as seen above.

Silica is useful in mixing with other pigments, largely because of its quality of presenting an excellent surface for repainting. This quality alone should recommend it for use in many of the paints used on ship-board, and the statement has been made that the time is not far distant when all good mixed paints will contain silica.

Asbestine is a silicate of magnesium, and is fibrous in character. It is extremely stable and when used in mixed paints has a ten-

dency to hold up the heavier pigments and to keep them from settling to the bottom of the container. It is used considerably in ready-mixed paints for this reason.

VARNISHES.

Varnishes are made ordinarily by melting the gums or resins, then adding hot linseed oil and, when the mixture has cooled sufficiently, thinning with turpentine or petroleum spirits. The varnishes intended for outside use, usually known as "spar varnishes," are made with better and harder gums and do not contain so much volatile solvent and consequently dry more slowly. Varnishes for interior use are usually not so expensive, have more volatile solvent and dry much more rapidly even in confined spaces.

Considerable skill is required in the manufacture of varnish and the results vary considerably between the products of different makers, even when the same materials have been used. Some makers, by the use of lower-grade gums and even common pine rosin, can produce better varnishes than their competitors can with the best materials. The only test of varnish that can be relied on is a service test, which, however, is prohibited by the length of time required before the varnish will wear out. It is, therefore, necessary to purchase varnish on specifications which require a chemical test only, and, though this cannot be regarded as showing conclusively the quality of a varnish, it is fair generally to assume that varnishes in which only the best materials have been used are of good quality and will give satisfactory results.

Damar varnish, which is made from damar gum and turpentine, without the use of oil, is used in mixing enamel paints for interiors of living spaces on ship-board. It was selected for this purpose due to its light color, although it is not so durable as the linseed-oil varnishes. With a slight sacrifice of whiteness, a gloss paint could be made by using an oil varnish that would be much more durable than damar varnish paint and cost no more. The flat-wall finishes made from lithopone that have become popular recently, contain a small percentage of varnish and for that reason will stand scrubbing quite as well as gloss paint made with damar varnish.

Asphaltum varnish is made in the same way as other oil varnishes by using a fossil asphalt, known as gilsonite, with linseed oil and a solvent. This kind of varnish has not very great durability.

Varnish gums or resins are fossil remains of exudations from trees and there are many varieties and grades. The older gums are harder, amber being the final result of aging. Varnish has been made with amber, but, due to the extreme heat necessary to melt it, the resulting varnish was dark colored and had no particular merit.

SPECIAL RUST-PREVENTING PAINTS.

The subject of corrosion of steel has received of late years considerable attention commercially, due to the amount of money being invested in buildings which depend for their existence upon the integrity of their steel structures. This steel is not subjected to the trying conditions that a sea-going ship experiences, for the reason that it is imbedded usually in cement concrete, and, moreover, is not exposed to salt water or air laden with salt moisture.

As a result of these efforts there have been developed a number of paints designed especially to prevent rusting of steel surfaces. While it would not be possible to discuss all of the different kinds and characters of these paints, it is believed that description of several of them, that have been used successfully to some extent in the navy, will be of interest in showing the possibilities and the breadth of the field.

A paint that has been used extensively in steel work of recent buildings contains as a pigment a mixture of oxides of silica, calcium and aluminum, resembling closely Portland cement, which is mixed with other materials and china wood oil. The latter has the property of forming a moisture-excluding film, while the cement absorbs, when applied, moisture that may be present on the surface and permits the use of such a paint on moist surfaces. These latter characteristics are sufficient to justify the substitution of such a paint for many localities in which red lead now is used. Its price, which is one-third less than that of red lead, and its protective and rust-preventing qualities, which have been shown by experiment to equal if not surpass red lead, are added reasons in favor of the adoption of such a paint for naval vessels.

A paint that has given excellent results when used on the interiors of trimming tanks of submarines is made with a graphite pigment and an asphaltic oil thinned with benzine. This paint has displayed remarkable protective qualities when used under the trying conditions mentioned above and its cost is less than one dollar a gallon. Red lead, which costs not far from two dollars

a gallon, though used generally for the purposes mentioned, does not give results that are even reasonably satisfactory, due to the fact that linseed oil films do not exclude water, and red-lead paint made with linseed oil will not adhere properly to a surface that has the slightest trace of moisture.

Another paint that has been tested extensively at the Brooklyn Navy Yard, for uses to which red lead has been put, is composed of a pigment similar to venetian red, containing iron oxide, calcium sulphate and silica, and of specially high quality of linseed oil, turpentine and driers. The merit of this paint appears to be due to the special quality of the linseed oil and the care used in manufacture, and, though it is somewhat more expensive than the others mentioned, the paint is much cheaper than red lead and appears to be more effective.

CONCLUSIONS.

An important consideration, and one that should not be lost sight of in connection with the paint situation in the navy, is the fact that rarely is paint allowed to live its full life, or the paint film to perish through the action of the elements. Occasionally in inaccessible places on ship-board the metal becomes badly corroded, either under paint, or else due to its absence. These cases are unimportant and can be attributed generally to the unsuitability of the paint used. Most of the paint, however, that is used on ships is painted over before it has perished. Ample proof of this is the thickness of the paint on various parts of old ships, and the scaling of old paint that goes on continually on men-of-war. Granting, for the sake of argument, that the new paint materials, such as turpentine substitutes, linseed oil substitutes, the inert fillers, etc., have not the durability of the materials heretofore used, it would even then be reasonable to use them. When a house on shore is painted, the owner expects the paint to last at least two years and would not consider cheaper materials if he felt that it would shorten the life of the paint appreciably. The labor cost of painting it too high. He does not expect to repaint until the paint film has disintegrated and the wood or metal begins to show through. Ships are repainted, however, for other reasons, and it is rare that any part of the ship that is visible goes more than one year without repainting, most of it being painted three of four times a year.

THE FUNDAMENTALS OF NAVAL TACTICS.

By Lieutenant Romeo Bernotti, Italian Navy.

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PART II.

MANEUVERING.

CHAPTER I.

Ideas on Naval Kinematics.

29. *Preliminaries.*—The motive that induces us to cite a few fundamental ideas on naval kinematics must not be sought for in a desire for mathematical divagations, nor for the study of battle maneuvers on the basis of aprioristic hypotheses concerning the movements of the enemy. The object that we propose for ourselves is that of determining criteria of the maximum simplicity, holding it to be an axiom that, in offensive contact, it is absurd to place confidence in tables, diagrams, or instruments for geometrical constructions. Furthermore, it is well to give notice that, while not excluding such means in contact out of range, and during exercises (and in the latter only until a sufficient habit in maneuvering is acquired), the only one of them that we deem indispensable for the conning of a ship under the fire of the enemy, is that composed of a horizontal disc upon which are marked the sectors of offense of the weapons, and in the center of which is a revolving alidade furnished with a sight vane.

But precisely in order to be free from all shackles, clearness of ideas is necessary concerning the solution of the principal problems of kinematics, and toward this we shall tend, limiting ourselves to the purely indispensable.

To fix the idea, let us refer to the case of two ships opposed to each other, observing that, on the basis of the deductions of Chapters I and IV of Part I, we cannot confine ourselves to considering the rectilinear tracks.

Indeed, in long-range battle, if we suppose that our ship is in the proper tactical zone, that the enemy bears approximately in a direction of maximum utilization, and that we maintain a constant course, after a short time—except in very particular cases—the inclination to the plane of fire could not be held to

answer to the tactical necessities; and hence it will be necessary to follow a new course.

In general, rather than change the course at intervals, and so disturb the fire control, there naturally comes the idea of satisfying the tactical necessities continuously rather than intermittently, by keeping the polar bearing of the enemy constant *for a certain time,* which can easily be done by means of the alidade of the instrument just mentioned. In this way, the track passed over is generally curvilinear; and its curvature is naturally a function of the enemy's track. As—steering thus by means of the sight vane—the ship continually changes her course, the doubt may arise that the disturbance of the firing may be continuous; we establish, then, the idea of taking also into consideration these curvilinear tracks, unless upon examination their radii of curvature prove to be very great. It is clear that if such conditions are realized, they present a real advantage by substituting continuous, but very slow, changes of course for those of notable amplitude between the successive courses of a broken right line.

Setting aside the effect upon the firing, it is intuitively seen that steering on a constant bearing may be advisable under some circumstances, because it permits the maximum simplicity of maneuvering that can conveniently be adapted in a continuous manner to the maneuvering of the enemy.

When the advisability of the continuous adaptation just now mentioned does not exist, and the problem is that of taking, with the greatest rapidity, a determined position with respect to a ship or a fleet of ships, the necessity of rectilinear tracks is evident. In fact, they permit of attaining the desired object in the minimum time, unless a curvilinear track may be convenient in order to diminish the uncertainties of the maneuver, and may permit of reaching the desired position in a space of time only slightly greater than the minimum.

In general, then, we may establish the necessity of rectilinear tracks:

(a) In contact out of range.

(b) In the maneuver of approach of a light, swift vessel.

(c) In the movements of friendly ships (evolutionary problems).

Bearing in mind what has previously been said, for the study of the movements of two ships—which forms the object of this

chapter—we are to consider rectilinear movements and those on a constant bearing.

30. *Indicator of Movement* (Fig. 12).—Let us consider the simultaneous positions of two ships, A and B, of which V_A and V_B are the respective speeds, and AA_1 and BB_1, the courses. If A_1 and B_1 are the simultaneous positions of said ships after an infinitesimal time dt, let us take A_1A_1' parallel and equal to BB_1, but in a contrary direction. The distance $A_1'B$ is equal to that of A_1B_1; moreover, the joining lines A_1B_1 and $A_1'B$ form the same angles with the courses of B and A. The geometrical locus of the points A_1' (of which A is the origin) is the trajectory or indicator of the relative movement of A with respect to B, called,

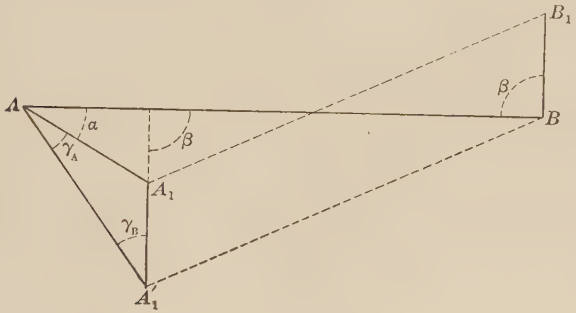

FIG. 12.

briefly, the *indicator of movement;* or, in other words, it is the track that the ship A, at a speed which is the resultant of V_A and V_B (the relative speed), passes over with respect to the ship B, which is supposed to be stationary.

31. *Generalities Concerning Rectilinear Movements* (Fig. 12).—If the tracks of A and B are rectilinear and the speeds V_A and V_B are constant, the indicator of movement will be rectilinear. In fact, from what has been said, the points of A_1' are aligned with A, the resultant of the speeds being also constant.

Consequently, if A must determine the proper course for bringing itself into a given position with respect to B, it is well to observe that the course that corresponds to the hypothesis of an immovable B is the indicator of movement; the problem is then reduced to that of passing from the indicator of movement to the course of A.

If we imagine a circumference described with its center at A and with any radius AA_1 which we take as a unit of measure, the course sought is obtained by joining A with the point A_1 of said circumference, the parallel from which point to the course of B cuts the indicator in a point, A_1', such that we may have *

$$\frac{A_1A_1'}{AA_1} = \frac{V_B}{V_A}.$$

If α and β are simultaneous polar bearings of A and B respectively (counted from the bow), indicating the relative speed by V_r, from the triangle AA_1A_1' we have

$$V_r = V_A\sqrt{1+\left(\frac{V_B}{V_A}\right)^2+2\frac{V_B}{V_A}\cos(\alpha\pm\beta)},$$

wherein it is necessary to use for β the positive or the negative sign, according as the two ships move toward the same side or toward opposite sides of the line joining them. The minimum value of V_r is $V_A - V_B$, which corresponds to parallel courses in the same direction.

If s is the segment of the indicator included between the points corresponding to the initial position and the final position, the time t necessary for completing the movement is

$$t = \frac{s}{V_r}. \qquad (1)$$

Furthermore, indicating the angles formed by the courses of A and B with the indicator of movement by y_A and y_B respectively, from the aforesaid triangle AA_1A_1' we obtain

$$\sin y_A = \frac{V_B}{V_A}\sin y_B. \qquad (2)$$

Since it must be that $\sin y_A \leqq 1$, there results from this relation: 1st, that any change of positon of a ship, A, with respect to another, B, which is steering a fixed course, is possible when $V_A > V_B$; 2d, that if A has not superior speed, there are possible only those changes of position for which $\sin y_B \leqq \frac{V_A}{V_B}$; 3d, for a value of y_B, two supplementary values of y_A satisfy the above-

* Marking off from A a segment $\frac{V_B}{V_A}$, parallel to the course of B and in the same direction as V_B, and drawing from its extremity the parallel to the indicator of movement, the point A_1 is determined by the intersection of this parallel with the circle of center A and radius 1. (Author's note.)

mentioned relation. It is easily seen, concerning the aforesaid geometrical construction, that when $V_A = V_B$, a relative speed, O, corresponds to one of the said values of y_A; if $V_A < V_B$, the relative speeds corresponding to the two values of y_A are made in the same direction; and this must be taken into account in order to select the proper value of y_A, since both the values of y_A bring one to the desired position, but in different times; finally, if $V_A > V_B$, the two values of the relative speed have contrary signs.

32. *Chase Problems.*—The simplest application of the preceding deductions consists in *determining the proper course for overtaking another ship.*

In this case, the indicator of movement is the joining line AB; therefore, during the movement, the two ships keep each other on the same polar bearings. The course sought can be determined with the geometrical construction, already mentioned, which it is superfluous to recall as it is practically done with an instrument having two alidades. The immediate determination of the proper course would require exact knowledge of the course and speed of the other ship; this not being presumable, recourse must be had to successive rectifications.

When there is no instrument available except one with a single alidade—mentioned in Section 29—the course to be steered must be estimated by eye and afterwards corrected until the polar bearing remains constant. In this way the ship A which gives chase generally follows a broken rectilinear track; we shall presently see how the rectifications just mentioned may be limited.

Conformably to observation 3 of the preceding section, the condition that the course steered should keep the polar bearing constant is necessary, but it is not sufficient to bring about a meeting; in fact, this may be verified for two courses of A which form supplementary angles with AB. When $V_A < V_B$ the meeting is not possible if B holds A on a polar bearing, from the bow, greater than that of which the sine is $\frac{V_A}{V_B}$. Both the above-mentioned courses may lead to a meeting, but naturally the one which makes the greater angle with the said joining line *cannot secure the object in the shorter time;* and the existence of such a solution is worth remembering in practice in order to avoid errors. In the case of $V_A = V_B$, the course that makes the greater angle with the joining

line and keeps the polar bearing constant, is parallel to the course of B; or, geometrically, it would lead to a meeting in an infinite time. Finally, when $V_A > V$, the course of A, which makes the greater angle, diverges from the course of B, and the ships may be considered as departing simultaneously from the point of intersection of the courses.

This being said, we observe that if A steers on a constant polar bearing equal or nearly equal to the one necessary for reaching a meeting in the shortest time, the indicator of movement is rectilinear, or it is very nearly a straight line; and hence A arrives at the meeting in the minimum time, or in a time slightly greater. It is unnecessary, then, to establish the precise condition that the

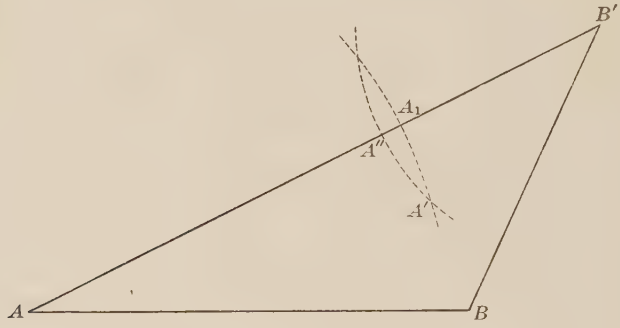

FIG. 13.

track of A be rectilinear; and this suggests the practical rule of not troubling oneself too much about the aforesaid rectifications of the course, *but determining an approximate course, and then steering so as to keep constant the polar bearing thus obtained.*

II. The problem just discussed is a particular case of the following: *To determine the course that a ship, A, must steer, with* a speed V_A, *in order to arrive, in the minimum time, from a distance R to a distance r from a ship, B, which steers a rectilinear course at a speed* V_B; *in case this is impossible, to determine the direction in which A must move in order to reach the minimum distance from B.*

In order to solve this problem, let us first of all demonstrate that if A' and B' are the positions of A and B when A has reached the distance r from B in the minimum time, the three points A,

A' and B' are in a straight line. This may easily be demonstrated by an absurdity.

Let us suppose $R>r$. Let us also suppose that A' is not upon the joining line AB' (Fig. 13) and that A_1 is the point of intersection of AB' with the circumference whose center is at A and whose radius is AA'.

Let A'' be the point of intersection of AB' with the circumference whose center is at B' and whose radius is $B'A'=r$. It is clear that AA'' is less than AA_1; if, then, the ship A had followed the course AB' it would have arrived at a distance from B less than r, in a time equal to that occupied in passing over AA'. Into such absurdity one always falls, except in the case in which A' is on the joining line AB'; the alignment mentioned is therefore necessary. The proposition enunciated is analogously demonstrated if $R<r$; that is to say, if, instead of diminishing the distance, A must increase it. From this it follows that when A arrives at a distance r from B, if this is accomplished in the minimum time, B must be found exactly ahead of him if $r<R$, or exactly astern of him if $r>R$.

If the ship A, which sees B pass ahead of it at the distance r, should continue on its course, it would evidently cross the track of B after a time $\frac{r}{V_A}$, in which time B would have passed over a space $r\frac{V_B}{V_A}$. It follows from this that, in order to execute the maneuver of approach from any distance, R, to a distance r, in the minimum time, it is not necessary to steer as if one wished to reach the ship, as was pointed out in Problem I, but *to maneuver in order to reach an imaginary point which is situated astern of B at the distance* $r\frac{V_B}{V_A}$, *and which moves with the speed and on the course of B.*

Evidently, the greater the distance r, and the smaller the advantage in speed that A has over B, the more important it is to bear in mind the difference between the exact solution—which results from the consideration just alluded to—and the approximate solution which corresponds to the hypothesis $r=0$, or to the other hypothesis $\frac{V_B}{V_A}=0$.

In contact out of range, in which there is a possibility of making a geometrical construction, the course sought is determined by laying off AB (Fig. 14), which may represent R, then taking a segment, $BH = r\frac{V_B}{V_A}$, in a direction parallel and opposite to the course of B, and finally forming (Section 31) the triangle AA_1A_1', in which A_1A_1' is parallel to BH, and wherein the ratio between the sides AA_1 and A_1A_1' is $\frac{V_A}{V_B}$. The solution may be obtained more simply by describing the arc of a circle with its center at B and with a radius r, cutting AH at a point H'; which indicates the course $H'B$ that A must follow, and in regard to which the general discussion of Section 31 is recalled to mind.

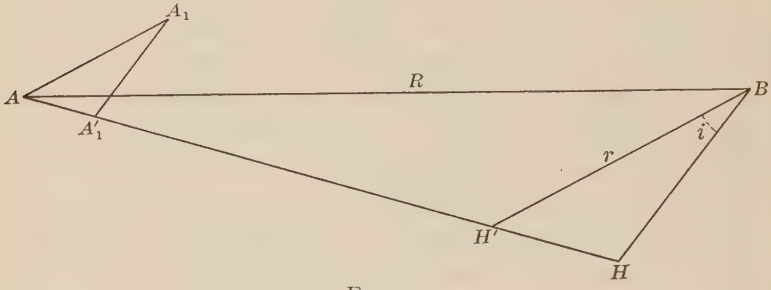

FIG. 14.

When A and B are in sight of each other the reason for applying the approximate solution in the manner indicated under Problem I, is that one cannot steer by sight vane for the point H, because that point is not distinguishable. Nevertheless it does not seem that the exact solution may be completely neglected, since we are able to come near to it, without any complication, by observing the following rule: *Maneuver initially as if it were desired to come to a meeting with B, and then, successively, at intervals, bring the sight vane by which we are steering toward B, more toward the bow, in such fashion that the said ship may be bearing ahead when the desired distance is reached.*

If $V_A < V_B$, so much the more necessary is it to refer to the general problem, inasmuch as the problem of meeting may be an impossible one; but we may approach to the minimum distance therefrom, which, as is seen in Fig. 14, is evidently that for which $H'B$ (and hence the course of A) is perpendicular to the indi-

cator of movement. In order to reach this minimum distance, the cosine of the angle i between the courses must equal $\frac{V_A}{V_B}$.

In contact out of range it is possible that it may be foreseen that the enemy will follow a broken rectilinear track when in the vicinity of the coast.

If the track of B (Fig. 15) is BB_1X, two cases may present themselves: 1st, A may arrive at the desired distance r from B, before B arrives at B_1; and then the solution is the one already

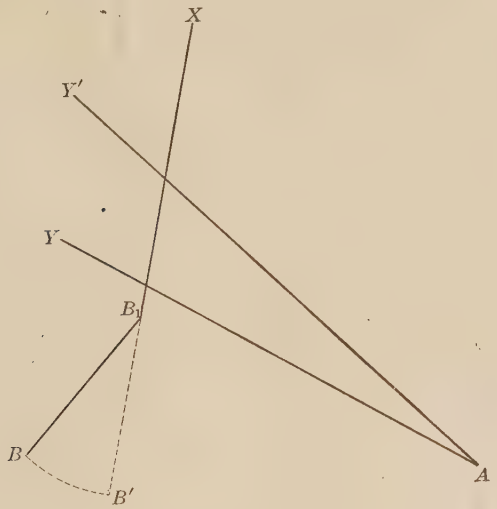

FIG. 15.

indicated. 2d, the course AY, along which A would have to move under the preceding hypothesis, intersects BB_1X in some point of B_1X. From B_1, then, we lay off on the prolongation of B_1X the segment $B_1B' = B_1B$. It is evident that the direction AY', in which A must move in order to solve the problem, is obtained by supposing that the movement of B always takes place along B_1X, and that B' is the initial position of B. Clearly, this course of reasoning might be extended to the case in which the broken rectilinear track has more than two segments.

When $r > R$, the solution of the problem enunciated is obtained in a way analogous to that required for $r < R$, observing that the course on which A reaches the distance r in the shortest time,

cuts the line of the course of B ahead of that ship, and at a distance $r\frac{V_B}{V_A}$; hence, unless A is exactly astern of B, the most opportune course for increasing the distance up to a certain limit as rapidly as possible, must be a diverging one.

33. *Evolutionary Problems.*—I. Let us suppose that B (Fig. 16) follows the course BX at a constant speed. If A finds itself,

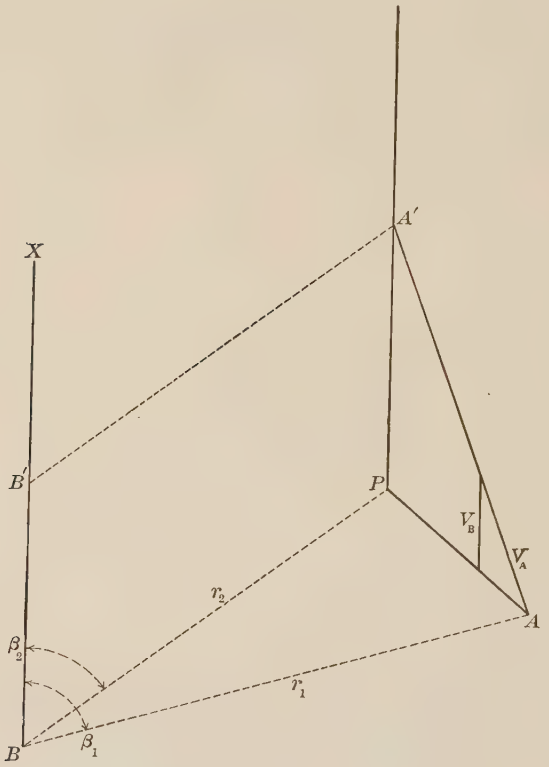

FIG. 16.

with respect to that ship, at a distance r_1 and on the polar bearing β_1, and desires to pass in the minimum time to the distance r_2 and to the polar bearing β_2—that is to say, to a position P with respect to B, which is supposed to be stationary—the line AP is the indicator of movement; and hence, with reference to it—as has been set forth in Section 31—setting aside the displacements due to changes of course, we may determine the course AA' that A must follow, and the necessary time.

The problem thus set forth is the one that presents itself when we aim at transporting ourselves from contact out of range, not only to a certain distance from the enemy, but also to a determined relative position.*

Moreover, what has just been said includes generically the cases realized in evolutions that are not performed in succession. If $\beta_1=\beta_2$, AB is the indicator of movement, and the evolution reduces itself to a change of distance; if $r_1=r_2$, the evolution consists of a change of bearing; the indicator of movement is then normal to the bisector of the angle PBA; that is to say,

$$PAB=90^\circ-\frac{\omega}{2},$$

ω being equal to $\beta_1-\beta_2$.

II. Let us now consider the changes of bearing.

The perpendicular segment dropped from B upon AP—that is to say, $AB\cos\frac{\omega}{2}$—indicates the minimum distance at which the ships will pass during the evolution; it is generally held that the distance ought not to fall below 7/10 of the normal distance, which establishes for ω the limit of 90°.

It is easy to find the formula which permits of obtaining the angle δ through which A must change course, supposing, naturally, that in the position A, the said ship has a course parallel to that of B. From the figure we get

$$\delta=180^\circ-\beta_1-PAB-y_A,$$

in which

$$PAB=90^\circ-\frac{\omega}{2},$$

and y_A is given by equation (2) of Section 31; that is,

$$y_A=\arcsin\left(\frac{V_B}{V_A}\sin y_B\right).$$

Then, since

$$\sin y_B=\sin(180^\circ-\beta_1-PAB)=\cos\left(\beta_1-\frac{\omega}{2}\right),$$

we obtain

$$\delta=90^\circ+\frac{\omega}{2}-\beta_1-\arcsin\left[\frac{V_B}{V_A}\cos\left(\beta_1-\frac{\omega}{2}\right)\right]. \qquad (3)$$

* If the movement of B, instead of being on a single course, can be predicted to follow a broken rectilinear track, the method to be followed is evidently analogous to that indicated in the preceding section. (Author's note.)

The change of course must be made toward B, or in the opposite direction, according as δ is positive or negative.

In order to be able to pick out the value of δ from a table, the latter might be one with two entries (that is, $\beta_1 - \frac{\omega}{2}$ and the ratio of the speeds).

In order to eliminate the use of tables, recourse should be had to diagrams,* to an instrument with an alidade, or to the method by parallel courses, making the ships change course through the angle $90° + \frac{\omega}{2} - \beta_1$ in a way that may result in the direction AP, B afterwards executing the reduction of speed. With this latter method the relative speed is $V_A - V_B$; and hence the time necessary for the evolution remains at that corresponding to the method above indicated (AP being always the same) in the ratio $\frac{V_r}{V_A - V_B}$, by virtue of equation (1) of Section 31. Hence it is evident that the evolution by the method of parallel courses can never occupy less time than that which is required by the other method, which we will call *the method by oblique courses.*

A general rule—which we shall suppose to be implicitly followed in the evolutions when nothing is specified to the contrary—is that the ship B at the beginning of the evolution (or before reducing the speed) makes the two changes of course (initial and final) that A makes at A and at A'; with this rule, mentioned by Admiral de Gueydon,† the displacements due to changes of course are rendered the same for A and for B.

III. *Definitions.*—If two ships have the same course and speed, and the one further advanced in the direction of the course is bearing from the other at an angle α from the bow, we say that it is on the *line of polar bearing* α.

By *wheeling a line of polar bearing* we mean the evolution by oblique courses which permits of rotating the line joining the two ships, at the end of which rotation the former polar bearing of the formation is re-established.

* PESCI: Sui metodi per cambiare il rilevamento fra le navi di una formazione semplice, *Rivista Marittima*, March, 1897.

† Tactique Navale. Recherche des principes primordiaux et fondamentaux de toute tactique navale (1868).

Fig. 17 shows a line of bearing that executes a wheel through an amplitude ω. The ship B—which is the one situated on the side toward which the wheel is to be executed—changes to the course BI', which makes with the original course BI the angle ω in the direction of the wheel; after this B reduces the speed, assuming a speed V_B, while A maintains the evolutionary speed, which we will designate by V_A. In order that the distance at the end of the evolution may be the normal distance, the indicator of movement must be AP, such that $PAB = 90° - \frac{\omega}{2}$; so that the course that A must follow is AA'. When A has nearly arrived at

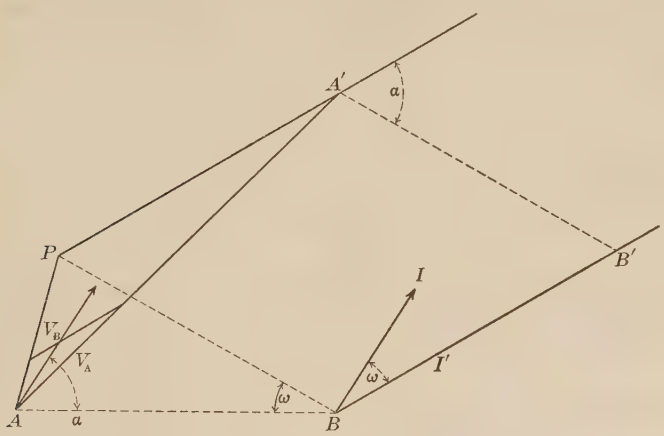

FIG. 17.

the position A', it changes to a course parallel to BI', while B again takes up the normal speed.

Evidently this problem is but a particular case of the one before presented, and, in its turn, the problem of wheeling a column of vessels is a particular case of this one. In such particular case the choice of the pivot ship is optional; that is, the line may be made to wheel about the rear ship or about the leading ship.

In 1905 we were led to consider the wheeling of a column of vessels by reading an important article entitled, *Notes on the Principles of Naval Tactics,* which appeared in the September number for that year of the *United Service Magazine,* signed by the pseudonym *Experience.* In the said article mention is made

of pivoting the line at one-third of its length from the leading vessel; we shall occupy ourselves with this problem hereinafter.

In wheeling the column, while the pivot ship turns through the angle ω in the direction of the wheel, the other ship must change from the original direction through an angle $\phi=\omega+\delta$, δ being the angle given by equation (3); the angle ϕ is positive or negative according as the change of course is made in the direction of the wheel or in the opposite direction.

Let us indicate by ϕ_c and ϕ_t the respective values of ϕ for the wheel on the rear ship and that on the leading one.

In the first case the value of δ is determined, bearing in mind that the pivot ship changes course through the angle ω, and that hence, in equation (3), it is necessary to put $\beta_1=\omega$; in this way we get

$$\delta=90^\circ-\frac{\omega}{2}-\text{arc sin}\left(\frac{V_B}{V_A}\cos\frac{\omega}{2}\right),$$

and hence

$$\phi_c=90^\circ+\frac{\omega}{2}-\text{arc sin}\left(\frac{V_B}{V_A}\cos\frac{\omega}{2}\right). \qquad (4)$$

For the wheel with the leading vessel as a pivot it is necessary to substitute in equation (3)

$$\beta_1=180+\omega,$$

from which we obtain

$$-\phi_t=90^\circ-\frac{\omega}{2}-\text{arc sin}\left(\frac{V_B}{V_A}\cos\frac{\omega}{2}\right).$$

Taking absolute values for ϕ_c and ϕ_t we get

$$\phi_c-\phi_t=\omega, \qquad (5)$$

which, together with equation (4), permits of the construction of a table which will give the angle of the change of course for a given speed ratio.

From equation (5) it is clear that, in order to apply the rule of De Gueydon, the pivot ship, in wheeling on the rear vessel, must change course through ϕ_c in the direction of the wheel, and afterwards execute a change through ϕ_t in the opposite direction; in the case of pivoting on the leading ship, the pivot ship must change course through ϕ_t in the direction opposite that of the wheel, and afterwards through ϕ_c in the direction of the wheel.

IV. By equation (1) of Section 31, the time necessary for executing a change of bearing (or a wheel) of an amplitude ω, is

$$t = \frac{AP}{V_r} = \frac{2AB \sin \frac{\omega}{2}}{V_r}, \qquad (6)$$

from which it is seen that *the duration of the evolution is proportional to the length AB of the line or column.**

Let us now compare the rapidity of wheeling a column of vessels by the two methods indicated.

Let B be the pivot ship (Fig. 18). According as the ship A is at A_2 or at A_1—that is to say, ahead or astern of the pivot—in order to wheel the line through ω, we find ourselves in the case of pivoting on the rear or on the head.

A_2' and A_1' being the corresponding positions of A at the end of the evolution, let us determine what must be the ratio $\frac{A_1B}{A_2B}$, to the end that we may have $A_2A_2' = A_1A_1'$. By virtue of the proportionality before mentioned, this ratio indicates the relative rapidity of the two methods, which we will indicate by $\frac{t_2}{t_1}$, t_2 and t_1 being the times respectively employed in the case of pivoting on the rear and on the head.

Considering the triangles A_1BA_1', A_2BA_2', by equation (5), we have

$$A_2A_2'B = \phi_t; \quad X_1A_1'B = \phi_c;$$

and hence

$$\frac{\sin \phi_t}{A_2B} = \frac{\sin \omega}{A_2A_2'}; \quad \frac{\sin \phi_c}{A_1B} = \frac{\sin \omega}{A_1A_1'},$$

* The ratio between the times necessary for the evolution by the method of parallel courses and by that of changing direction in succession is

$$\frac{2 \sin \frac{\omega}{2}}{V_A - V_B} V_A,$$

or the first of these methods is more rapid if

$$\sin \frac{\omega}{2} \leq \frac{1 - \frac{V_B}{V_A}}{2}.$$

With this formula, for $\frac{V_B}{V_A} = \frac{1}{2}$, $\omega \leq 29°$; for $\frac{V_B}{V_A} = \frac{8}{10}$, $\omega \leq 12°$.

Then, from what has been said in division II, the evolution by oblique courses is proper in limits wider than these. (Author's note.)

from which—as, by hypothesis, $A_2A_2' = A_1A_1'$—we obtain

$$\frac{A_1B}{A_2B} = \frac{\sin \phi_c}{\sin \phi_t}.$$

Calculating ϕ_c and ϕ_t by means of equations (4) and (5), we deduce from this formula the values of the ratio $\frac{A_1B}{A_2B}$, which

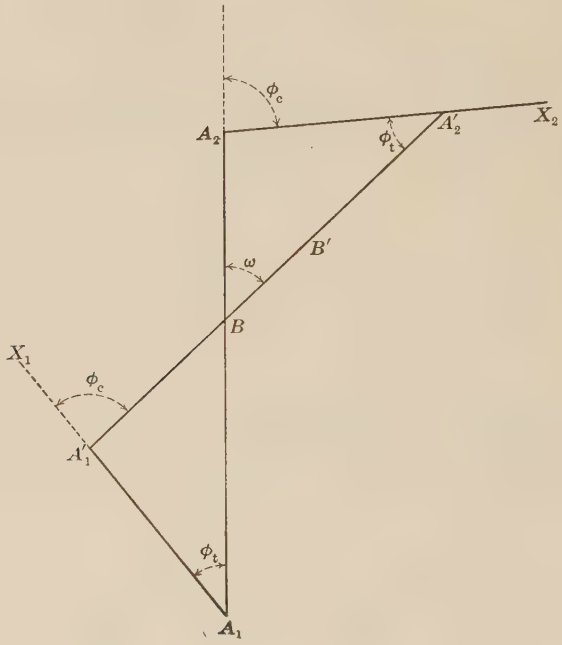

FIG. 18.

values, set down here below opposite ω, are determined under the hypothesis that $\frac{V_B}{V_A} = \frac{1}{2}$.

ω	$\frac{t_2}{t_1}$
15°	1.16
30°	1.35
45°	1.57
60°	1.78
75°	2.00
90°	2.24

It results from this table that the greater rapidity is obtained by pivoting on the head; by the other method, for the supposed speed ratio, about double the time is employed if ω is between 60° and 90°, and one and a half times more if ω is between 30° and 45°.*

Let us now consider the time required for changing the direction of the line through the angle ω by changing course in succession, and compare it with that required by a wheel with a pivot at the head; setting aside the time employed in changes of course.

Indicating by t_0 the time required for the change of direction by changing course in succession, we have

$$t_0 = \frac{AB}{V_A}, \qquad (7)$$

while the time required for the wheel is given by equation (6); hence

$$\frac{t_1}{t_0} = \frac{2V_A \sin \frac{\omega}{2}}{V_r}.$$

In the case we are considering (pivoting on the head), in the formula of Section 31, which gives V_r, it is necessary to put

$$\alpha = \phi_t; \quad \beta = 180° - \omega;$$

and by equation (5) we obtain

$$\alpha - \beta = \phi_c - 180°;$$

therefore we have

$$V_r = V_A \sqrt{1 + \left(\frac{V_B}{V_A}\right)^2 - 2\frac{V_B}{V_A}\cos\phi_c}.$$

There results, then,

$$\frac{t_1}{t_0} = \frac{2 \sin \frac{\omega}{2}}{\sqrt{1 + \left(\frac{V_B}{V_A}\right)^2 - 2\frac{V_B}{V_A}\cos\phi_c}}.$$

* It is easily seen that $\frac{t_2}{t_1}$ increases the more $\frac{V_B}{V_A}$ approximates to unity. It is well to note that, in any evolution, we may not adopt in practice a ratio $\frac{V_B}{V_A}$ less than ½; indeed it must be remembered that the speed of the pivot ship is not instantaneously reduced, and hence, in order to have the mean speed V_B during the evolution, the engine must be regulated for a lower speed. (Author's note.)

With this formula, for $\frac{V_B}{V_A} = \frac{1}{2}$, there are calculated the values of $\frac{t_1}{t_0}$ set down in the following table, in which are also written the values of $\frac{t_2}{t_0}$ obtained by multiplying the values of $\frac{t_1}{t_0}$ by the corresponding values of $\frac{t_2}{t_1}$ given in the preceding table.

ω	$\frac{t_1}{t_0}$	$\frac{t_2}{t_0}$
15°	0.28	0.32
30°	0.51	0.69
45°	0.71	1.11
60°	0.86	1.53
75°	0.99	1.98
90°	1.09	2.44

Having regard to the rapidity and to the simplicity of the evolution, and reserving it to ourselves to discuss the subject in relation to the movements of the enemy, this table permits us to announce the following conclusions:

1st. *When ω is greater than 30°, a change of course in succession is preferable to a wheel on the rear ship.*

2d. *A wheel on the leading ship may be preferred to a change of course in succession when ω is within the limit of 60°.*

Within the limits thus established, indicating by t a value of t_1 or of t_2, and t_0 being the corresponding value given by equation (7), putting $\frac{t}{t_0} = m$, we have

$$t_0 - t = \frac{AB}{V_A}(1 - m).$$

The gain in time permitted by a wheel is then directly proportional to the length of the line.

34. *Determination of the Course and of the Speed of the Enemy.*—I. The principal force (or the main body of the fleet), on information from the units that keep the enemy in sight and determine his course and speed with the closest approximation possible, can execute the maneuver of approach in the way indicated in Sections 32, II, and 33, I.

The preliminary problem reduces itself to the hypothesis of a ship, A, that wishes to determine the course and the speed of another ship, B.

With this object in view, the ship A keeps on a constant course

and, at any interval, t, of some minutes, it repeats the measurement of the distance and the polar bearing on which B lies. Drawing the triangle $AA_1'B$ (Fig. 12), wherein AB and $A_1'B$ represent two measured distances, and the angle at B is the difference between the corresponding bearings, the line AA_1' is the indicator of movement; consequently, marking on the drawing the course of A and taking on it the segment AA_1, equal to the distance passed over by the ship in the time t, the segment $A_1'A_1$ will represent, in direction, the course of B, and in length, the distance passed over by the said ship in the said time.

With these measurements, two values for the course as well as for the speed sought may thus be obtained; hence, the mean of these may be taken, and so proceeding, an approximation may be reached which is so much the closer, the greater the number of measurements made.

But we note that, under the circumstances in which the problem must be solved, the distance AB may be predicted to be in the neighborhood of 15,000 meters, and may be even greater; hence but scant confidence can be placed in the accuracy of the indications supplied by the range finders. For this reason it is well to observe that, in the determination of the elements we are seeking, we may proceed with a graphic method, based upon the measured polar bearings and the spaces passed over in the intervals, supposing the distance to be only roughly known.

For this very simple method, devised by Lieutenant P. Corridori, it is expedient: 1st, to follow a course that is not parallel to that of B; 2d, that, considering the surface of the sea to be divided into two parts by the joining line AB, the two courses be *not* directed toward the same side of the line.

This being said, here, in a word, is the method: We mark off on a straight line which represents the track of A (Fig. 19) the points A, A_1, A_2, ... corresponding to the space passed over in the interval established between the successive measurements, and then we draw from these points the straight lines AB, A_1B_1, A_2B_2, ... forming with the above-mentioned line the measured polar bearings.

With a graduated ruler, estimating by eye the direction followed by B with respect to A, we seek, by trials, to find the position that the ruler must assume in order that the segments BB_1, B_1B_2 . . . . may be equal among themselves. Such a position

of the rule is the line of the course of B, and the scale of the drawing supplies his speed.*

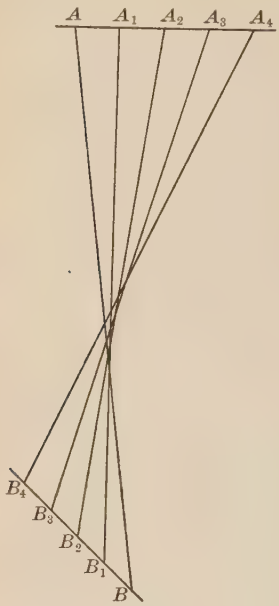

FIG. 19.

Having a fairly good knowledge of the distance, the two methods above indicated may be combined; in other words, AB and A_1B_1 being marked down, taking into account the first two distances measured, we place the ruler in the direction of BB_1. When the next measurement permits of marking down A_2B_2, we determine a more approximate position of the rule, so that BB_1 may be equal to B_1B_2, and so on.

II. When the fighting forces that have to execute the movements corresponding to the preceding sections are in sight of the enemy, it is obvious that they may not delay beginning those movements in order to determine his course and speed; but it is well to take an approximate course, keeping it constant for some minutes, in order to attempt such a determination by the first of the methods just pointed out, and afterwards be governed by the established rules.

* Evidently if the successive joining lines were all to intersect in one and the same point at a distance finite or infinite (parallelism), the position of the rule would be indeterminate. It is to be noted that theoretically this indetermination exists in any case because the curve traced through the intersections of the joining lines AB, A_1B_1, A_2B_2, ... is a parabola; consequently an error in the initial distance AB produces errors in the speed and in the course. However, when the angle between the courses is within opportune limits, the above-mentioned errors are very small, even when the distance is very roughly known; for example, when a distance of about 15,000 meters is estimated with an approximation of $\pm$ 2000 meters.

If the polar bearing were exactly measured, for the application of the method, it would suffice to limit the said measurements to three; but on account of the inevitable errors it is well to take at least five or six bearings, well distanced, for example, at intervals of five minutes. Concerning the probability of so doing it is well to bear in mind that in contact out of range, when the naval forces are not in sight of each other, the course and the speed will not be frequently changed. (Author's note.)

35. *Fundamental Tactical Relation.*—In order to establish criteria of practical utility, the study of the offensive contact must be made in the most general form, considering the supposed adversary free at any moment to keep our ship on the bearing that he may deem most advisable.*

The basis for the study of the types of maneuvering that we shall develop in the following chapters must be sought in a general relation that shall bind together the *elements of movement* of the two ships; that is to say, the respective speeds, the polar bearings, and the variation of the distance. To such a relation we shall give the name of *fundamental tactical relation.*

Two ships, A and B, follow any two tracks. At the moment we are considering, they have the respective speeds V_A and V_B and they have each other on the bearings α and β from the bow.

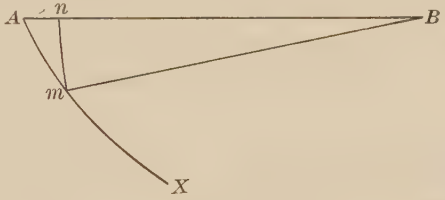

FIG. 20.

The indicator of movement is a curve AX (Fig. 20), of which the tangent at A, which is the direction of the relative speed V_r, forms with AB an angle which we indicate by δ.

If m is a point on the indicator infinitely near to A, describing the arc mn of a circle with its center at B, the triangle Amn may be considered a right triangle, right angled at n; hence

$$An = Am \cos \delta.$$

Letting dr and dt be respectively the differentials of the distance and of the time, since dr is negative when a diminution of the distance is produced, by substituting for An and Am their values, we have

$$dr = -V_r \cos \delta dt.$$

* Suppose, for example, that the enemy follows a constant course, or some other track of geometrically determined form, it is well understood how a proper measure might easily be decided upon; but such a deduction would be of small importance, because it would be based upon too particular a hypothesis. (Author's note.)

Projecting V_r and its components, V_A and V_B, upon AB, as the projection of the resultant is equal to the algebraic sum of the projections of the components, we obtain

$$V_r \cos \delta = V_A \cos \alpha + V_B \cos \beta.$$

Substituting in the preceding equation, there results

$$\frac{d_r}{d_t} = -(V_A \cos \alpha + V_B \cos \beta),$$

which is the relation sought. Putting

$$\theta = 180^\circ - \beta,$$

the fundamental relation may be written

$$\frac{d_r}{d_t} = V_B \cos \theta - V_A \cos \alpha,$$

in which it is to be remembered that θ is counted from the stern and α is counted from the bow.

36. *Constant Bearings.*—If the two ships A and B do not alter their speed, and steer on constant polar bearings, $\frac{d_r}{d}$, or the variation of the distance in the unit of time, also becomes constant, and hence the distance varies proportionally to the time.*

In case the speeds are constant, but the polar bearings are variable, the fundamental relation gives the variation of the distance in a time sufficiently short to enable us to consider α and θ as practically constant during that time. Let us see what may logically be held to be the variability of the elements of movement.

Trusting to our dexterity in firing, we may propose to ourselves to cause the distance to vary rapidly; that is to say, to render $\frac{d_r}{d_t}$ the maximum. It is well to observe, however, that we control our polar bearing and our speed; that is to say, only one of the

* It is to be noted that when the speeds and bearings are constant, V_r and δ become constant; the indicator of movement of one ship with respect to the other thus cuts the straight lines drawn from its initial point at a constant angle; it is, then, an equiangular or logarithmic spiral, the pole of which is in the said initial position. The spiral naturally becomes a circle when the distance is kept constant, and is reduced to a straight line when the conditions of movement cause the ships to arrive simultaneously at the point of intersection of their attacks, or when the two ships may be considered as setting out simultaneously from the said point. (Author's note.)

terms of the second member of the fundamental relation. Well and good; by keeping the enemy on a variable polar bearing we shall not be able to oblige him to do likewise, and we shall renounce important benefits. In fact, a constant bearing may opportunely be chosen (Part I, Chapter I); moreover, it facilitates the control and the execution of the firing. The control is advantaged since it must necessarily be based upon the hypothesis that the variation of the distance in the interval between two successive salvos is approximately constant, and certainly the fact that we do not change the gun pointing in direction is good for the execution of the firing.

It is very probable that the enemy also may maneuver well; that is, he may be inspired by the same ideas. In studying the types of maneuvering we shall not exclude the possibility of his withdrawal; but meanwhile *it may be held to be a sufficiently general hypothesis that* α *and* θ *do not change for a certain time.* With regard to the speed, it is evidently important to vary it as little as possible.

37. *Curvature of the Ship's Track.*—It is now expedient to ascertain whether the movement on a constant polar bearing may in any case produce sensible disturbance to the firing.

The ship A, when the enemy B has him bearing at an angle θ —to port, for example—produces, by virtue of the fundamental relation, the same variation of distance whether he keeps B bearing at the sight vane angle α to starboard or to port; because, in that way, the values of α to be introduced into the fundamental relation are equal and with contrary signs; that is to say, $\cos\alpha$ does not change. However, according as A keeps B at an angle α, presenting to the fire of the enemy the starboard or the port side, it changes, not only the track of A, but also that of B; although the side that the latter presents may be the same in both cases.

Let us indicate by ρ'_A and ρ'_B the radii of curvature of the tracks of A and B at a given instant, in case the ships present to the fire sides of opposite names; while ρ''_A and ρ''_B indicate the radii in the case in which the ships present sides of the same name.

As, by hypothesis, the bearings are kept constant, the angle through which A and B change course in a given time is the same; and is equal to the angle through which the line joining the adversaries rotates. Let $d\sigma'$ be the said angle for the movement

in the time dt, with sides of opposite names, while we indicate its value in the movement with sides of the same name by $d\sigma''$. Denoting by dS_A and dS_B respectively the differentials of the arcs of the tracks of A and B, there results

$$\left.\begin{aligned} dS_A &= \rho'_A d\sigma' = \rho''_A d\sigma'' = V_A dt \\ dS_B &= \rho'_B d\sigma' = \rho''_B d\sigma'' = V_B dt \end{aligned}\right\}, \tag{8}$$

and hence

$$\frac{\rho'_A}{\rho'_B} = \frac{\rho''_A}{\rho''_B} = \frac{V_A}{V_B}. \tag{8}$$

We may then affirm that, *at any instant, the ratio of the radii of curvature of the tracks is constant and equal to the ratio of the speeds.*

Indicating by ρ' the radius ρ'_A or ρ'_B, and by ρ'' the corresponding ρ''_A and ρ''_B, there results from (8)

$$\frac{\rho'}{\rho''} = \frac{d\sigma''}{d\sigma'}. \tag{9}$$

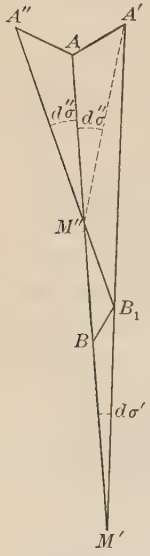

FIG. 21.

This being the case, let B_1 (Fig. 21) be the position of B after the interval of time dt, and let A' and A'' be the corresponding positions at which A arrives according as he selects the movement with the side of opposite name or with the side of the same name.

Prolonging AB and $A'B_1$ to their intersection at M', and calling M'' the point of intersection of AB and $A''B_1$, we have

$$AM'A' = d\sigma', \quad A''M''A = d\sigma'';$$

but since by hypothesis

$$A''AB = A'AB = \alpha,$$

we have also

$$AM''A' = d\sigma''.$$

The angle $d\sigma''$ being thus an exterior angle of the triangle $A'M''M'$, we have

$$d\sigma'' > d\sigma';$$

and hence, by equation (9),

$$\rho'' < \rho'.$$

It is thus established that, *if a ship fights presenting to fire the side of the same name as that of the enemy, the radius of curvature of its track is at any moment less than it would be if, with the same sight-vane angle, the ship should present the side of the contrary name. The rotation of the joining line is more rapid.**

With the object of completely fixing the ideas concerning the subject we are discussing, it is sufficient to have recourse to the relation that gives the value of $\frac{d\sigma}{dt}$, which is determined in a manner analogous to that of the fundamental relation, as follows:

In order to get the angular displacement in the time dt of the line joining the two adversaries, we observe that the length of the arc corresponding to the angle—that is, $rd\sigma$—is equal to the difference of the displacements normal to the joining line in case the sides presented are of opposite names, and to their sum in case the sides presented are of the same name; we have then,

$$\frac{d\sigma}{dt} = \frac{V_A \sin \alpha \mp V_B \sin \theta}{r}, \qquad (10)$$

wherein the negative sign corresponds to σ' and the positive sign to σ''.†

We observe that there results from (8)

$$\rho = \frac{V}{\frac{d\sigma}{dt}},$$

V indicating the speed of the ship A or that of B, and ρ the corresponding radius of curvature. Substituting for $\frac{d\sigma}{dt}$ its value, given by (10), we get

$$\rho = \frac{V}{V_A \sin \alpha \mp V_B \sin \theta} r, \qquad (11)$$

* Evidently we may also reach this deduction when referring to the relative speed. When A and B present to fire sides of the same name, the relative speed is greater than in the other case, and is nearer to the direction normal to the joining line AB. (Author's note.)

† The values of σ' deduced from this relation are positive when the ship A sees the line joining it with the enemy inclined in the direction in which the ship is moving; they are negative in the opposite case, which is realized when

$$V_A \sin \alpha < V_B \sin \theta.$$

(Author's note.)

which confirms the preceding results, and demonstrates further that *the radius of curvature varies proportionally to the distance.* This relation is the one sought and upon which we may base conclusions.

When we say that the changes of course disturb the firing we have reference to the changes with the helm hard over, or with a radius of 400 or 500 meters; this is the limit to which it is necessary to compare the radii of curvature of the tracks.

Referring to the case in which the adversaries present sides of the same name—that is, to the case in which the radii are shorter—it is necessary to establish whether they are great enough not to affect the fire control.

Let us, then, consider the values of ρ'', laying down the observation that, while the values of ρ are different in the case of sides of opposite names and in that of sides of the same name, their ratio, by virtue of (8′), is constant; that is, the relative conditions of the adversaries do not change, and, for the values that the speed ratio may have in practice, these conditions may be held not to differ sensibly.

We will therefore consider the values of ρ''_B, supposing B to be the slower ship; these are given by (10), making therein $V = V_B$, and taking the positive sign in the denominator. Let us refer to a ratio $\frac{V_A}{V_B} = \frac{1}{2}$, and to a single, $r = 500$ meters; because, for the other values of the distance, it is sufficient to take into account the proportionality between ρ and r. Given the ordinary amplitude of the sectors of maximum offense (45° forward of and 45° abaft the beam), we may limit ourselves to varying α and θ between 45° and 90°, because the values of ρ''_B that are realized in the other cases enter into those that are deduced with the preceding data.

VALUES OF ρ''_B (METERS).

θ \ α	45°	60°	90°
45°	3210	2860	2620
60°	2910	2620	2420
90°	2700	2450	2270

These values show that, *in long-range battle, the radii of curvature, when steering on a constant bearing, have in any case values so considerable as to exclude disturbance of the firing; rather, the*

values of ρ'' are such that steering by sight vane may be adopted, even against an enemy who keeps his course unchanged.

In closing the distance the values of ρ'' diminish in a way to cause disturbance to the firing, while the values of ρ' are always very large; in fact, it is enough to bear in mind that the minimum ρ' is 5060 meters, which in practice (under the logical hypothesis that B fires with a maximum number of guns) corresponds to $\theta=45^\circ$ and $\alpha=90^\circ$, for $r=2500$. *Hence, at close range we may steer by sight vane, presenting to fire the side of the name opposite that of the enemy; when presenting the side of the same name we must steer rectilinear courses.*

CHAPTER II.

MANEUVERS OF TWO SHIPS OPPOSED TO EACH OTHER.

38. *Importance of the Study of the Naval Duel.*—In this chapter we propose to study the maneuvers of two ships opposed to each other, excluding the case of the attack upon a battleship by a torpedo boat, which will be discussed hereafter.

First of all, it is well to reflect that there is but scant probability of single combats, considering that the more important a ship is, the less rational will be its isolation. Thus, in order to increase the zone explored by a fleet, we might be induced to extend the battleships also in chain, as well as the cruisers. This might seem to be advisable if our ships possessed a speed superior to that of the enemy's similar ships, so as to be able to effect concentration in good time. But such advisability must be excluded, because the conditions under which the meeting with the enemy will take place can never be foreseen. Without need of entering into discussions of a strategic character, as an elementary measure of precaution we may establish the general rule that the battleships should cruise together, and that the armored cruisers should be able to rejoin the main body with facility. Only on account of the material and moral superiority that one has in the pursuit which succeeds a victorious battle, can it be permissible to abandon, at least in part, those precautions that are indispensable in the presence of an enemy in full efficiency.

Duels, then, are to be predicted between the lighter ships; nevertheless, it is not expedient to limit ourselves to examining the hypothesis that may be formulated in this respect. The study of combat between two ships furnished with vertical armor, powerfully armed and protected (battleships or armored cruisers), if it is of improbable practical application, is of importance to us because it serves as a starting point for the study of squadron combat. Indeed, in maneuvering a fleet, the ideal at which it is necessary to aim is that of securing an advantageous position with respect to the enemy, minimizing for each ship the hindrances that derive from its association with the others; or, it is necessary that the maneuvers of each ship, with respect to

that of the enemy upon which it is directing its fire, should approximate, as far as possible, to the maneuvers that it would make if it were alone.

Thus there results the advisability of studying the naval duel in a general way. We shall suppose that the maneuvering is not hampered by the coast or by other causes, and afterwards we shall allude to some special cases.

39. *Distance Kept within Limits and Constant Distance.*—It is clear that the maneuvering of our ships in long-range battle must *generally* satisfy the conditions of keeping the enemy bearing in a sector of maximum offense. Subordinately to this, in whatever way the enemy may maneuver, the maneuvering may be intended either to preserve the distance that one has at the actual moment, or to change it.

Let us now consider the first of these hypotheses. We have recognized (Part I, Chapter IV) the impossibility of assigning a strictly determined value to the distance of maximum utilization; we likewise know (Part I, Chapter I) that the directions of maximum utilization are to be considered as elements of the highest importance for tactical maneuvering. Hence, it would seem logical to establish that the maneuvering should be developed by keeping the enemy in directions of maximum utilization alternately forward of and abaft the beam; in this way the conservation of the distance that is deemed favorable for our ship should be understood in the sense of causing it to vary, keeping its variation, however, within the limits of the zone of maximum utilization. This form of maneuvering, which is called *maneuvering with limited distance,* cannot be established in an absolute way. In fact, it evidently leads to changes of course that disturb the firing when one passes from the bearing forward of the beam to that abaft the beam or vice versa; and, furthermore, one is obliged to present the beam at such moments; further still, one of the two phases, either that of the bearing forward of the beam or that of the bearing abaft the beam, will be very short, as may easily be seen by calculating (with the fundamental relation) how rapidly the distance varies between two ships that keep each other bearing in the same general direction from the beam.

From this arises the idea of *keeping constant some value of the distance included in the zone of maximum utilization, on a suitable polar bearing,* whenever this may be possible.*

Evidently, the first condition necessary in order that the distance may be constant, is that of keeping the enemy bearing abaft the beam when he has us bearing forward of the beam, or vice versa.

The necessary relation between the speeds and the polar bearings in this form of movement is that which, in the fundamental relation, makes $\frac{dr}{dt} = 0$; that is to say:

$$V_A \cos \alpha = V_B \cos \theta,$$

* The French admiral, Fournier, in his book called "La flotte necessaire" (1896), was the first to study the combat with limited distance, putting the question in the following terms: The task of the vessel that wishes to draw profit from an advantage in speed is to maneuver, presenting his side in such a way as always to keep his adversary at the most effective range of his guns, without allowing him to approach within a distance arbitrarily fixed as the limit of safety. He studies the maneuver of the swifter ship on the basis of the following theorem: If two ships having speeds V_A and V_B ($V_A > V_B$) start at a distance r_0, and the swifter vessel follows a logarithmic spiral with its pole in the initial position of the slower ship, and inclined to the radii vectors in such a way as to keep the pole bearing at an angle whose cosine is $-\frac{V_B}{V_A}$, while the slower ship steers on a radius vector, the distance between the two ships varies until it returns to r_0, when the swifter ship passes ahead of the other. Fournier based himself on the hypothesis that the slower party, with the intention of diminishing the distance, might follow a rectilinear course, or keep his bow constantly on the enemy. In consequence of this, and of the fact that the faster ship, which passes over arcs of a logarithmic spiral conformably to the theorem aforesaid, has not the enemy constantly bearing in a sector of maximum offense, the maneuver with limited distance in the way proposed by Fournier is not acceptable. (See our study entitled "La velocita nella tattica navale," in *Rivista Marittima* of January, 1900). Nevertheless, Fournier's book efficaciously contributed to the progress of Tactics by initiating the study of long-range battle. Following Fournier came Commander (now Admiral) Baggio-Ducarne, who, studying the application of Fournier's criteria (*Rivista Marittima,* April, 1897), adjudged to Admiral Saint-Bon the merit of having, in 1885, perceived and demonstrated, in a tactical exercise, the advantage that a ship, swifter and more powerful than another, may draw from long-range battle. Comandante Ronca first pointed out the convenience of keeping the distance constant (*Rivista Marittima,* June, 1897). (Author's note.)

which we will call *the equation of constant distance.* It results from this that, theoretically, a ship, A, can maneuver at a constant distance from another ship, B, in two ways: 1st, at a *constant speed*, pre-establishing V_A, and determining the polar bearing α on which he must keep the enemy by means of the equation

$$\cos \alpha = \frac{V_B}{V_A} \cos \theta,$$

so that α is constant if B keeps θ and V_B constant; 2d, on a *constant bearing,* pre-establishing the polar bearing in which the enemy must be kept, and assuming the speed

$$V_A = \frac{V_B \cos \theta}{\cos \alpha},$$

so that V_A is constant if B keeps θ and V_B constant.

Each of these methods presents grave inconveniences. Brief considerations suffice to show that, in general, *with one of the above-mentioned methods, if the maneuvering of the enemy is not rational, our maneuvering also cannot be the most opportune.*

With the method at a constant speed, if B keeps A on a variable bearing, θ (as may happen, for example, when B keeps the course constant), α must also be variable. If $\theta = 90°$, α must also be 90°; corresponding to $\theta = 0$ and $\theta = 180°$, we have, respectively, $\cos \alpha = \frac{V_B}{V_A}$ and $\cos \alpha = -\frac{V_B}{V_A}$. Consequently, if the enemy should constantly present his beam, in applying this method our ship should act in the same manner, which is illogical. If the enemy has our ship bearing in line with the keel or in a sector of minimum offense, with the values that the speed ratio may assume in practice, our polar bearing also would generally be outside of a sector of maximum offense. Moreover, if $V_A > V_B$, $\cos \alpha < \cos \theta$; and hence, supposing B to maneuver rationally and keep A in a direction of maximum utilization, the ship A, in order to keep the distance constant and develop the maximum speed, must bring the enemy to bear nearer to the beam, or, in a direction that may be a less defensive one.

With the method on a constant bearing it might be necessary to vary the speed between very wide limits; that is to say, from the value $\frac{V_B}{\cos \alpha}$ to the value *zero* corresponding to $\theta = 90°$.

Neither of these forms of maneuvering can, in an absolute way, be held to be acceptable, as has already been said concern-

ing that with the limited distance; but, instead, it will be easy to see how the three methods, considered together, permit of formulating practical rules of great simplicity.

We may reach such rules with the aid of the following observations:

I. It would be absurd to vary the speed in the way that might be required by the method on a constant bearing, but limited variations of the speed, from the maximum to a speed inferior by four or five knots, are acceptable.

II. Analogously, it may be admitted that our sight vane may be moved from a direction of maximum utilization as much as 15° or 20°, approaching nearer to the beam, or reaching an extreme limit of the sectors of maximum offense.

III. When the enemy keeps our ship bearing in a direction very near the beam, the variation of the speed and of the bearing within the limits above mentioned is not sufficient to keep the distance constant; maneuvering with a limited distance is then rendered necessary, and we need not be concerned about having to present the beam at intervals, because the enemy is continually in that disadvantageous condition.

IV. When the enemy, for reasons that we shall specify, can control the variation of the distance and avails himself of that faculty, it is evidently necessary to develop the maximum speed and steer with the sight vane on an extreme limit of the sectors of maximum offense, thus hindering the maneuvering of the enemy as much as possible. This being said, the rules for the practical application of the criteria alluded to are evident.

40. *Maneuvering in Long-Range Battle.*—Our ship is, by hypothesis, within the limits of distance that are held to be advisable. We have the usual disk provided with a sight vane. On it, PP' (Fig. 22) indicates the direction of the keel; OS and OS' are the limit directions of the sector of maximum offense SOS'.

Let us suppose that the enemy has our ship bearing forward of the beam. We steer on a constant bearing, arranging the sight vane in the direction OM, which is the after direction of maximum utilization, and we develop the maximum speed.

Three cases may present themselves; that is to say, the distance may remain constant, or it may increase, or it may diminish.

In the first case we have but to continue to steer with the sight vane in the direction OM.

In the second case, that is, when the distance increases, continuing to steer with the sight vane on OM, we reduce the speed little by little, and it is possible that, within the limits established for the diminution (four or five knots), we may find a speed that will keep the distance constant. When this is not realized, even for the said inferior limit of the speed, we gradually move the sight vane nearer to the beam, without, however, going beyond

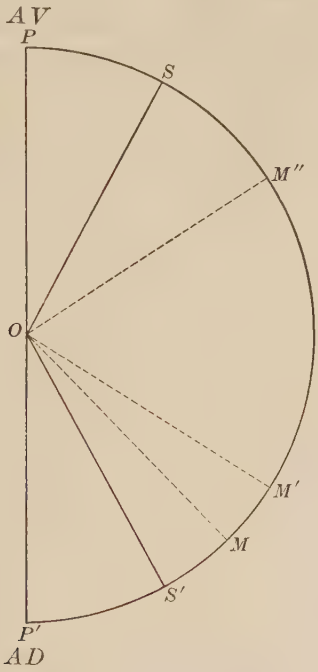

FIG. 22.

the pre-established limit OM'. If, even with this limit direction, the distance still increases, we continue to steer with the sight vane in the direction OM' and, before arriving at the superior limit of the distance, we change our course, steering at the minimum speed with the sight vane in the direction OM'' symmetrical with OM'.

In the third case, that is to say, when the distance diminishes, keeping to the maximum speed, we move the sight vane gradually toward OS'. This limit being reached, if the distance continues to diminish, we may not move the sight vane further toward the

stern, because that would be without the sector of maximum offense. Evidently the enemy is master of the maneuvering, and we must continue to steer with the sight vane in the aforesaid direction in order to minimize the variation of the distance. We should maneuver in a perfectly analogous manner if the enemy had our ship bearing abaft the beam.

41. *Rotation of the Line Joining the Adversaries.*—It results from the foregoing that, with two adversaries that maneuver rationally, besides being able to presume that they may steer maintaining constant polar bearings, the *typical case* to be con-

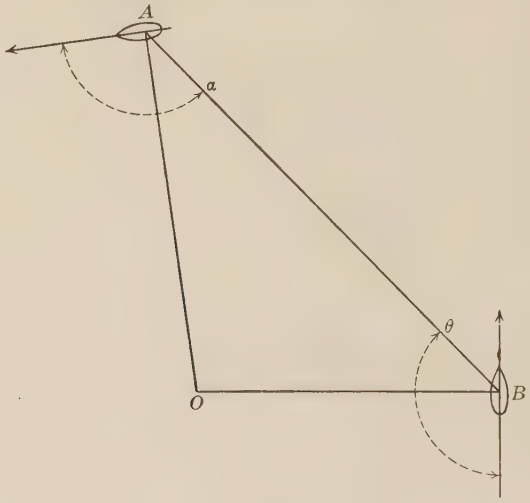

FIG. 23.

sidered is that wherein, for a certain time, the distance remains about constant.

It is easily demonstrated that, *if two ships steer keeping constant polar bearings, and if the distance also remains constant, the tracks followed by the two adversaries are concentric circumferences.* In fact, by equation (11) of Chapter I (Section 37) the radii of curvature of the tracks described by the ships A and B in the case we are now considering are constant, and hence the tracks are circumferences; moreover, the normals to the tracks always intersect in a point O (Fig. 23), by which we have

$$\frac{OA}{OB} = \frac{\cos\theta}{\cos\alpha},$$

and hence, from the equation of constant distance, there results

$$\frac{OA}{OB} = \frac{V_A}{V_B},$$

and O is then the common center.

Fig. 24 shows the circumferences passed over by ships supposed to be initially at A and B; the centers O' and O'' of the circumferences that the ships follow in presenting sides of the same name or sides of opposite names are naturally found on the perpendicular to the initial course of the ship B, which is supposed to have A always bearing to port. Conformably to

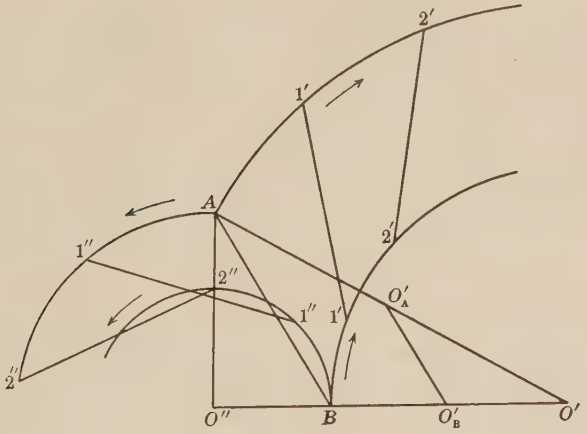

FIG. 24.

what has been demonstrated in a general way in Section 37, the radii of the circumferences with their center in O'' are shorter than those of the circumferences that have their center in O'; and hence, in the movement with sides of the same name, the rotation of the line joining the adversaries is more rapid; which is important in relation to what is said in Section 21 concerning the natural elements.*

* The demonstration that the tracks of A and B in the case under consideration are concentric circumferences can also be made without having recourse to the aforesaid formula (11). In fact, if the center of curvature of the tracks of A and B were not coincident and fixed, they would be, for example, at O'_A and O'_B on the respective normals to the tracks; and by virtue of equation (8') of Chapter I, and of the equation of constant dis-

The expediency of presenting to the enemy the proper side in order to keep or to secure an advantageous position with respect to the sun, or to the coast, or to the strategic objectives, is clear; therefore it is important to fix the ideas concerning the rapidity of rotation of the joining line.

The speeds, the polar bearings and the distance being constant, it results from equation (10) of Chapter I that *the speed of rotation of the line joining the adversaries is constant.* With the said formula we may calculate the time required for the joining line to rotate through a given angle.

We note that, if the speeds of A and B are equal, or, if $\alpha=\theta$, the point O' is at infinity, and the tracks of the two ships are parallel straight lines; while the circumferences with their center at O'' are reduced to one only, since $\rho_A = \rho_B$. This being the case it is clear that, *applying the type of maneuvering indicated in the preceding section,* conditions near to these will be realized when the directions of maximum utilization of the ships are not inclined in a sensibly different way. We may conclude from this that, *in general, when the adversaries present to each other sides of opposite names, the rotation of their joining line may be held to be very slow.*

When, on the other hand, the two adversaries present to each other sides of the same name, the rotation of the joining line is very rapid; thus, supposing A and B to be distant from each other 9000 meters, that they have each other bearing at 45° from the beam, and that $V_A = V_B = 15$ knots, the time necessary to rotate the joining line through 90° is only 23 minutes. However, for the case in which, by presenting to the fire the side of the same name as that of the enemy, we may expose ourselves to having a rotation of the joining line in a direction contrary to that desired, let us see how the rotation can be obtained by presenting the side of the opposite name.

It is clear that, in order to have the maximum component of the speed normal to the joining line, it is necessary to maintain the maximum speed instead of reducing it according to the cri-

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tance, the line $O'_A O'_B$ should at all times be parallel to the joining line AB. But, considering the positions A' and B' of the two ships after the time dt, $O'_A O'_B$ should also be parallel to $A'B'$, and hence we should fall into an absurdity. In order to avoid this we must admit the coincidence above mentioned. (Author's note.)

terion given in the preceding section; and it is expedient to have the enemy bearing as near as possible to the beam, or, in one of the pre-established limit directions OM', OM'', of Fig. 22. If with the sight vane in one of these directions the distance changes, we continue to steer in this way up to the limit established for the distance, and then steer in the symmetrical direction with respect to the beam. So doing, by virtue of the aforementioned formula (10), the ship A sees the line joining it with the enemy incline itself in the direction in which the ship is moving, if there is realized the condition

$$V_A \sin \alpha > V_B \sin \theta.$$

When A has sufficient speed to permit the existence of this inequality, it is best to recognize that the above-mentioned maneuver is suitable only when a rotation of moderate amplitude is required. In fact, if $V = 18$ knots, supposing the bearing on which A steers to be such as to keep the distance constant, r, θ, and V_B being the same as in the example previously considered, two hours are required in order to rotate the joining line through 90°; but it may be observed that, to make the joining line rotate through 270°, by presenting to fire the side of the same name as that of the enemy, the necessary time would be $\frac{270}{90} \times 23$ minutes, or a little more than half the time above mentioned. Hence, for rotations of great amplitude, *avoiding the inconveniences of keeping the enemy bearing too near the beam and gaining in celerity, it would be advisable to produce the complement in* 360° *of the required rotation.*

We may then establish:

1st. In order to maintain an advantageous position with respect to the sun, to the coast, or to the strategic objectives, we must present to fire the side of a name opposite that of the enemy, applying the general type of maneuvering indicated in the preceding section.

2d. We must present to fire the side of the same name as that of the enemy, applying the general type of maneuvering, when in that way the rotation of the joining line takes place in the desired direction, or when the amplitude of the desired rotation is very great.

3d. If in presenting the side of the same name as that of the enemy the rotation takes place in the direction contrary to that

desired, if, furthermore, the desired rotation is of small amplitude and we have a speed superior to that of the enemy, it is well to present the side of the opposite name, maneuvering by the rules just pointed out. When, however, we have not sufficient speed for obtaining the object established, it is necessary to maneuver as has been said in the preceding case.

It results from the foregoing that it may be easier to maintain an advantageous position than to acquire it. In general we can have but little faith in being able to apply the second of the preceding deductions, for it is presumable that the enemy, when he sees our ship present the side of the same name as his own, may change the maneuver by exposing his other side if he deems it to his interest to avoid a rapid rotation of the joining line. Still, the contrary might happen when, for example, the enemy has commenced firing before we have done so, and does not wish to change the side, in order to avoid the disadvantage to the fire control that would be produced.

Evidently it would be a fine game if the enemy were obliged to present a determined side, as would be realized if his offensive field were unsymmetrical with respect to the longitudinal axis.

42. *Change of Distance.*—I. It is clear that in order to obtain a change of distance without sacrificing offensive power, a ship A must develop the maximum speed and keep the enemy bearing at the forward limit of a sector of maximum offense if he desires to diminish the distance, or at the after limit if he desires to increase it. The enemy B, in order to maneuver by the same standard, hindering the change, must keep A bearing respectively at the after limit, or at the forward limit of a sector of maximum offense.

By the fundamental relation, the ship A may impose a change of the distance when

$$V_A \cos \alpha > V_B \cos \theta ;$$

α and θ corresponding in this case to the limits of the sectors of maximum offense.

II. Let us now suppose that the two adversaries are at the limit of offensive contact. The object of the ship A is to engage in a decisive combat with the ship B, which, not being able to prevent the approach of A, proposes to limit the action to the maximum distances. It is easy to see that if the ship B is powerfully armed on the line of the keel (has powerful head and stern fire), it may

be interested in keeping the stern always toward the enemy. In fact, if A, steering by sight vane, keeps B at the forward limit of a sector of maximum offense, calling this bearing α—counted, as usual, from the bow—by the fundamental relation (wherein we must, in this case, put $\theta=0$) it results that the necessary condition to the end that the distance may not increase, is

$$\frac{V_A}{V_B} \geq \frac{1}{\cos \alpha}.$$

Consequently, the minimum speed necessary for A, in order to develop against the enemy the maximum power without falling out of range, is that corresponding to the greatest amplitude of the sectors of maximum offense; or it is determined by the relation

$$\frac{V_A}{V_B} = \frac{1}{\cos 30^\circ} = 1.15.$$

Putting $\Delta = V_A - V_B$, we have

$$\frac{V_A}{V_B} = 1 + \frac{\Delta}{V_B},$$

or

$$\Delta = 0.15\, V_B.$$

Hence it results that the superiority in speed required by A is so much the greater, the greater is V_B; or, while a greater speed per hour of 1.5 knots is necessary for the object mentioned against a ship of 10 knots speed, when $V=20$ knots, there is required an advantage of 3 knots.

This said, the following observations should be made:

1st. The aforesaid advantage in speed simply permits the ship A to keep B under the fire of his guns, but does not admit of his diminishing the distance.

2d. As has been pointed out in Part I, Chapter I, some ships can develop a strong intensity of fire in the direction of the keel—much greater than that of which they are capable in the sectors of minimum offense; moreover, it is well to remember (Section 3) that, at the maximum fighting distances, a ship presenting itself end on to the enemy's fire diminishes in that way the enemy's percentage of effective hits.

3d. It is true that, being removed by a small angle from the direction of the keel, one enters a sector of minimum offense; but this may also happen for the limit direction of the sector of

maximum offense on which A is steering; in other words, if A desires to provide against the inexactness of steering by sight vane, rather than at 30° from the bow, it ought to keep the enemy at about 35°; but then, for $V = 20$ knots, there would be required an advantage in speed of 4.4 knots, rather than of 3 knots. It seems, then, that we may affirm that, even supposing the sectors of maximum offense to have the maximum amplitude, without a great advantage in speed, not presumable in practice, the situation is not very decidedly favorable for A. On the other hand it appears to be clear that *B may not be interested, in this case, in conforming to the general rule, which is that of keeping the enemy bearing in a sector of maximum offense.*

If the ship A, then, has not a speed which greatly exceeds that of B, his desire to succeed in the intention to diminish the distance constrains him to keep his bow toward the enemy; which obliges him to endure, for a very considerable time, a disadvantageous situation, when the strength of his fire in line with the keel is inferior to that of the enemy. In fact, it is sufficient to note that, in order to diminish the distance by at least 2000 meters—which it is important for A to do in order to engage in a quickly efficacious action—the necessary time is that which would be required for passing over the said space at a speed $V_A - V_B$; or, it is more than 20 minutes if the difference in speed is about 3 knots.

When, however, the ship A, besides being the swifter, has also a more powerful fire in line with the keel, it is clear that B will be obliged to bring it to bear in a sector of maximum offense; we then come back to the case already discussed at the beginning of this section.

In the general case of two ships opposed to each other on the open sea, we may then conclude:

1st. That, for declining a decisive tactical action, powerful stern fire may constitute a compensation for inferior speed.

2d. That a speed superior by two or three knots, even if associated with the maximum amplitude of the sectors of maximum offense, cannot be held to be sufficient for imposing the tactical action; powerful fire ahead is more important for securing that object.

43. *Capacity for Tactical Initiative.*—A ship has complete liberty of tactical initiative with respect to another if it can

impose or decline offensive contact; and if, in case it engages, it can give to the action the form that is deemed preferable, or can control its development.

After what we have said, it is easy to estimate in what degree such liberty is possessed; that is, to determine the elements of the *capacity for tactical initiative* with reference to the usual hypothesis of ships opposing each other on the open sea.

I. In the general case in which the distance at which the ships sight each other is beyond the limit of offensive contact, equality of speed is sufficient for avoiding said contact, while, to impose it, a superior speed is necessary.

II. For the slower ship, the capacity for limiting the offensive contact to the maximum distance is inversely as the capacity of the faster ship to impose a decisive combat; in practice, they depend essentially upon the relative potentiality of the two adversaries in fire in line with the keel.

III. As between two ships that keep each other bearing in sectors of maximum offense, the capacity for controlling the distance depends upon the relative conditions of maximum speed and of amplitude of the sectors of maximum offense; these two factors should be considered together for each combatant; or, a compromise between them is possible. Indeed, as is seen from the fundamental relation, the aptitude of a ship to control the distance depends upon the product of its speed by the cosine of the angle formed by the longitudinal axis with a limit direction of the sector of maximum offense. If the forward limit direction of this sector forms with the direction of the bow a certain angle, $\alpha-\mu$, this places the ship in the condition in which it would be found if the limit direction formed the angle α, but the maximum speed V had an increment, kV, k being a coefficient that renders

$$V\cos(\alpha-\mu)=(V+kV)\cos\alpha;$$

hence we have

$$k=\frac{\cos(\alpha-\mu)}{\cos\alpha}-1.$$

If we were considering the after limit direction of the sector of maximum offense it would be necessary to put $180^\circ-\alpha$ in place of α, and $180^\circ-\alpha+\mu$ instead of $\alpha-\mu$; hence the formula found for k is a general one.

In the three hypotheses (Section 2) of sectors of maximum offense extended to 30°, 45°, and 60° from the beam, the values

of k for $\mu = 5°$ are respectively 0.14, 0.08, 0.04. For $\mu = 10°$ the values of k just given are doubled; that is, k may be held to be proportional to μ. For the ordinary case in which the two ships have sectors of maximum offense with amplitude near to 45° forward of and abaft the beam, it is then to be remembered that *if a ship has, with respect to another, the limits of the sectors of maximum offense nearer to the longitudinal axis, every 5° of difference of this kind, or every 10° of advantage in the total amplitude of the sectors, is equivalent, in the particular regard now under discussion, to an increase of speed of 8/10 of a knot for every 10 knots.*

IV. Generally the maneuvering of a ship in the duel is developed by keeping the adversary in one of the four fractions of the sectors of maximum offense; as, *SOM''*, *S'OM'* of Fig. 22, included between the limit directions of said sectors and the directions nearest the beam to which corresponds a sufficient defensive capacity; *the wider these partial sectors are, the greater is the liberty of maneuvering.* From this comes the superiority that is derived from greater thicknesses of armor than those of the enemy, or from guns with greater penetrating power.

V. To the end that a ship may be able to impose the rotation of the line joining it with the enemy, it must be able to obtain, with respect to the enemy, a greater component of its speed normally to the said joining line. This depends upon the relative speed conditions and upon the angles that, for each ship, the directions *OM''*, *OM'* of Fig. 22 form with the beam. *In this particular respect an advantage in speed is hence equivalent to a greater thickness of armor or to a greater penetrating power of the guns.*

From the preceding observations it results that the importance of the various elements of the capacity for tactical initiative cannot be considered in a one-sided manner.

It is incontrovertible, then, that the said capacity increases with the amplitude of the sectors of maximum offense; but with this amplitude (Section 3), the ratio between the potentiality in line with the keel and that of the said sectors diminishes; nor, on the other hand, can an increase of the said amplitude render an advantage in speed less desirable. This deduction is to be borne in mind when considering the types of ships.

44. *Maneuvering at Close Range.*—Let us examine the manner in which maneuvering at close range may be developed; that is to say, within the limits of the fourth tactical zone distinguished in Section 24, when the employment of the torpedo is possible, and hence, from what we demonstrated in Section 9, it is preferable to have the enemy bearing abaft the beam.

It must be borne in mind (Section 3) that the probability of being hit by the guns at close range, while it remains constant if the direction in which the enemy bears is not removed more than 45° from the beam, rapidly increases beyond that limit; therefore it is not advisable to have the enemy bear more than 45° from the beam, or, it is not advisable to utilize a greater amplitude of the sectors of maximum offense.

In maneuvering at close range, then, we should generally have the enemy bearing in a direction of maximum utilization abaft the beam, and should present to fire the side of a name opposite that of the enemy; because in that way it is possible to steer by sight vane (Section 37), which permits of satisfying the tactical necessities in a continuous manner.

If the enemy has our ship bearing forward of the beam, it is well to develop the maximum speed or a speed somewhat inferior —as has been said for maneuvering at long range—with the intention of keeping the enemy at the desired distance. For some moments we may change the angle of the sight vane when this may be necessary in order to launch the torpedoes; we must not, however, forget the risks we run in presenting the beam at close range; and hence it is necessary to establish it as a rule, not to execute, within the limits to which we are referring, any passage from a bearing abaft the beam to one forward of the beam, or vice versa. In consequence of this, except in the case to which we shall now allude, the launching tubes of the forward sectors should be utilized by launching for an angled run.

It is clear that if the enemy maneuvers analogously, keeping our ship bearing abaft the beam, neither of the combatants is within the radius of action of the torpedo; the duel then remains an artillery battle exclusively.

Let us consider the situation of two adversaries that, at close range, have each other bearing forward of the beam.

The distance diminishes; the ship that, at a certain moment, in order to avoid a further diminution of the distance, brings the

enemy to bear abaft the beam, while the enemy continues to keep it forward of the beam, presents the beam during the change, and hence makes—as has been said before—a perilous maneuver.

If neither of the adversaries makes such a maneuver, and if they present to fire sides of opposite names, they come to close quarters.

When the sides exposed to fire are of the same name, if one of the adversaries desires to fight at close quarters, the other cannot avoid it; let us suppose that this is not desired by either of the combatants. They keep the course constant; and, if the courses are parallel, the polar bearings are the same at any moment. *Thus, passing on opposite courses, inasmuch as it leads the two adversaries to present the beam simultaneously, may seem an opportune form of maneuvering for two combatants, both desirous of using the torpedo.* However, it is to be noted that only in appearance are the combatants in identical conditions; *the more strongly armored ship acquires the advantage,* owing to the fact that the adversary abandons maneuvering on the bearing which would permit him to compensate for, or at least diminish, the greater vulnerability of his armor.

Under the hypothesis that the enemy has our ship bearing forward of the beam, we may then conclude:

1st. It is not necessary to have the enemy bearing forward of the beam at close range, unless we intend to provoke a battle at close quarters, or unless we have decided to undergo it.

2d. Not desiring battle at close quarters, the maneuver of having the enemy forward of the beam may be rational when our ship has side armor of greater thickness.

45. *Limit of Battle at Close Quarters.*—Below a certain distance from the enemy, a ship may be assured that, if a collision takes place, it may run into the other, instead of being itself run into.

Theoretically, when we have the greater speed, we run no risk in having abaft the beam an enemy who has us forward of the beam; but it is necessary to take unforeseen elements into account, and hence the necessity of not having the enemy abaft the beam below a certain distance, determined under the hypothesis of equal speeds and equal evolutionary qualities for the two combatants. This distance marks *the limit of battle at close quarters.*

Let us consider two ships, A and B (Fig. 25), that have each other bearing respectively the one astern and the other ahead, and that have the same speed, V. Let us hold their evolutionary curves to be circular. We must seek the maximum distance, AB, which will permit A to arrive at K' at the same time as B.

Let us admit that the arcs BK and MK' are passed over in the same time—which is not rigorously true, since one is described

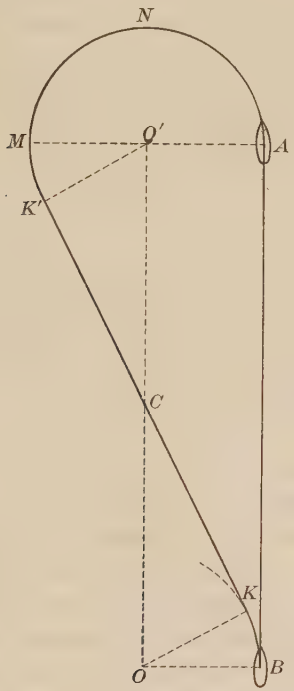

FIG. 25.

at the beginning, and the other at the end of an evolution. KK' must be passed over in the time that A takes in passing over the semi-circumference ANM.

Indicating by ρ the radius of the circle of evolution, since A loses about one-third of his speed, we have

$$\frac{KK'}{V} = \frac{\pi\rho}{\frac{2}{3}V},$$

or

$$KK' = \tfrac{3}{2}\pi\rho.$$

Since $AB=2CO'=2\sqrt{\overline{O'K'^2}+\overline{CK'^2}}=2\sqrt{\rho^2+\frac{1}{4}\overline{KK'^2}}$, substituting for KK' its value, we obtain

$$AB=\rho\sqrt{4+\tfrac{9}{4}\pi^2}=5\rho \text{ (about)}.$$

On the basis of the values that we may attribute to ρ, and considering that the value found for AB refers to the extreme case wherein A has the enemy bearing exactly astern, we may hold the distance of 2000 meters to be the limit of battle at close quarters.

46. *Maneuvering at Close Quarters.*—Battle at close quarters has lost the importance that it had in the past when it was held to be the principal form of action; for this reason we shall confine ourselves to brief considerations.

The ramming maneuver against a ship with freedom of movement is extremely hazardous. Indeed, the instant at which a ship must reach the intersection of its track with that of the enemy in order to obtain the object of ramming him, differs very little from that at which the said ship would be itself rammed. For this reason, and owing to the fact that modern ships have in the gun and in the torpedo most powerful means of fighting, it is to be admitted that neither of the adversaries is likely to maneuver with ramming as the principal objective.

In maneuvering at close quarters we must nevertheless take into account the possibilities of ramming; that is to say, we must maneuver so as to avoid being rammed. In other words, it is necessary to maneuver *defensively* with respect to ramming.

The *offensive* maneuver for ramming would require having the bow directly toward the enemy; for this reason, when the tactics of the ram were a subject of study, it was admitted that the two combatants would have steered initially bow against bow; but, afterwards, considering that such a direct clash would have placed both the adversaries in identically disadvantageous conditions (no matter how different might be their structures), it was held by the majority of the authors that the two ships would have turned aside little by little. As a collision at a small angle is dangerous for the rammer as well as for the rammed, it was also admitted that the two ships, in order to avoid it, would both have turned aside with the same helm, thus changing the collision into a grazing, or slipping past at short distance; after which they would have executed offensive turns with intent to ram.

For the *defensive* maneuver with respect to ramming, it is not necessary—as it is for the *offensive* maneuver—to tend to keep the enemy at an angle from the bow less than that at which he keeps us, but it is sufficient that the two bearings be equal. On the basis of this consideration, the form that it seems the initial phase of battle at close quarters between two modern battleships should assume, is not exactly that which appeared probable in the tactics of the ram. Within the limit of distance indicated in the preceding section, the two ships will run to meet each other; but, instead of steering bow to bow, they will keep on their guard, following parallel courses; there will thus be, not a grazing by, nor a passing at very short distance, but a passing at a distance of some hundreds of meters, such as to permit making use of the guns and the torpedoes.

After passing by, and before the enemy gets out of the after sector of maximum offense, it is evidently logical to turn in order to keep him in that sector; therefore the two ships will turn at that time toward each other; and afterwards, for the same reason, they will change course again, thus following parallel broken straight lines, having each other bearing abaft the beam; and hence, they will draw away from each other. Given—but not conceded—that the passing by may not have had the gravest effects, if one of the ships desires to provoke a repetition of the preceding phase, it will have to turn toward the enemy in order to bring him to bear about 45° forward of the beam; the other ship will be obliged to turn also in the same way.

It is to be noted that while admitting it to be unlikely that one of the ships will maneuver, after the passing by, in order to ram, the other—unless his mobile and evolutionary qualities are greatly inferior—by turning with the helm hard over, will be in time to present his bow to the adversary. Hence we deem rational the opinion of to-day favoring the abolition of the ram.

47. *Particular Cases.*—In practice—as was said at the beginning of this chapter—particular circumstances will determine the form that the duel will assume.

Ordinarily one of the adversaries will be sensibly weaker than the other, and will seek to reach a movable or a fixed center of protection. Hence it is possible that the enemy may or may not be found between the center of protection and the ship that desires to decline battle.

In the second case the weaker ship will evidently have to run; and will place itself in safety if it has an advantage in speed, or if its inferiority in speed is not too great, and if the radius of action in which the said ship must operate has been conveniently established, taking into account the speed of the enemy's strongest ships.

In case, however, it is indispensable to reckon with the enemy in order directly to reach the center of protection, the weaker ship could run away if it had an advantage in speed, and seek to throw the enemy off its track; but when it is feared that in this way the ship may run into preponderating hostile forces, it will steer directly for the center of protection, thus coming into a fight at close quarters with the enemy.

This is the case in which encounters between torpedo boats very often take place, especially during blockading operations, as has been demonstrated in the Russo-Japanese war. The destroyers and torpedo boats of the defense, having come out during the night in search of the enemy's battleships, returning at daylight toward their base, may encounter on their route similar units of the enemy; and as, for the said vessels, running to seaward would signify exposing themselves to certain loss, they will be obliged to fight. The adversaries will steer for each other bow to bow, so that the fight will first be developed in line with the keel, and afterwards, by passing each other on opposite courses, at very close quarters. After this, the units of the blockading party, unless they have sustained injuries that impede their freedom of maneuvering, will invert the course, following the enemy to the vicinity of the base.

Between protected cruisers, when the weaker is the slower, and has not a potentiality of fire in line with the keel that is sufficient for maneuvering by the rule given in Section 42, or when for any reason it cannot avoid a decisive action, it will seek to escape from the bad situation by provoking battle at close range. The stronger ship will evidently be interested in keeping the enemy at a distance.

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THE HYDRAULIC INTERACTION BETWEEN PASSING VESSELS, CALLED "SUCTION."

A LECTURE DELIVERED BEFORE THE SCHOOL OF MARINE ENGINEERING, U. S. NAVAL ACADEMY, ANNAPOLIS, MARYLAND, APRIL 17, 1911.*

By Sidney A. Reeve, M. E., Consulting Engineer.

The subject of suction is regarded by most pilots with considerable fear. They all know, from hearsay, from practice, and from experience that suction exists, and that it is a force which, when uninterrupted, is usually unconquerable. Yet, no one seems to be able to lay down the principles of its action for the guidance of pilots. Indeed, to most of them, it is an undefinable force. Out of nearly fifty pilots whom I have heard testify in these cases in court, the majority have never had any experience with a case of suction. Others have had merely one, usually the case in which they were called. So that the ordinary pilot or sea-faring man cannot, from his own experience and judgment, tell when suction is to be encountered and when it is not.

I shall show that the term "suction," which is a term uniformly used, is usually misleading. We speak of attraction, interaction, reaction and repulsion; and replusion is about as common as is attraction. Repulsion, however, much less often leads to serious results, and so does not get into the records as frequently as attraction in the matter of collisions.

I will first run over briefly a few cases of suction collisions, in order to give you a general idea of how they happen, and then will take up the matter more in detail. The phenomenon has been known on the records from which I quote since 1869. But I

*For a full understanding of these notes reference should be made to charts of New York Lower Bay and of Delaware River.

should say at the start that what I have to say is not drawn from by any means an exhaustive investigation of the records. I have not had time to do that. The only records which are accessible to the layman for this purpose are the records of the courts, and frequently in the cases coming before the courts suction is not known as a contributing factor to the accident, and so no mention is made of it in the indexes. I have not had time to make an exhaustive search, but I have a sufficient number of instances to illustrate all which we need at the present time.

The phenomenon has increased in later years with the growth in tonnage and speed of vessels, and a corresponding increase in depth of channels. At the same time, the records go back a good many years. The earliest case I have is one which happened in 1869. In that year two Sound steamers, the *Narragansett* and the *Providence* left their piers in North River and proceeded around through Hell Gate, the *Narragansett* being the slower vessel and in the lead. She was overtaken by the *Providence,* the faster vessel, and then occurred a phenomenon which is a part of the suction principle, and that is that the slower vessel was towed by the faster vessel by hydraulic interaction all the way up through East River. She was enabled to maintain a speed equal to the faster vessel without any change in her steam or engines. When the vessels got into Hell Gate the equilibrium became too unstable and they collided. The slower vessel, as usual, plunged into the quarter of the faster vessel.

The next instance on the list happened in 1872, and was a collision between tugs, the *McCandless* and the *Unit.* This was in comparatively deep water. There are no other details given, except that the collision was of the most common type, that is, the slower vessel had been almost overtaken and passed and then plunged into the quarter of the overtaking vessel. I might explain, in going over these, that we can immediately classify them into two types of collision, by attraction and by repulsion. All these which I am running over now are in the attraction class.

The next case happended in 1878 or 1879. A fleet of excursion boats going to one of the International races off Scotland Lightship was led by the tug *Hartt;* this tug was overtaken by the excursion steamer *City of Brockton.* As the *Brockton* went by and had almost passed the tug, the bow of the *Brockton* being about one hundred feet ahead of the bow of the *Hartt,* on the starboard

hand of the *Hartt,* the tug took a sudden sheer to starboard, toward the *Brockton,* then straightened up again. Then the commander put her under a starboard helm, and she took a very sudden plunge into the port quarter of the *City of Brockton,* running into the port paddle, and was almost overturned.

In 1880 there was a collision off Corlear's Hook, in the harbor, between the tug *Imperial* going up near the wharves and the ferry-boat *Garden City,* following after. In that case the vessels were on converging courses.

In 1885 occurred the first case of two large trans-Atlantic steamers, the *Aurania* and the *Republic,* leaving New York Harbor, just about to enter the turn into Gedney Channel, near the Fairway Buoy, There again the overtaken vessel got under the quarter of the vessel leading. It is interesting to note that just fifteen years later there was a similar collision of two vessels of about the same tonnage, in almost exactly the same place, and under almost exactly similar circumstances, the case of the *Martello* and the *Mesaba.* I will take that up later, in detail.

In the '90s there was a collision between the steamer *Owen* and the smaller steamer *Atlantis,* in the Detroit River. In 1898 there was also a collision between two freighters in the Delaware River, the *Aurole* and the *Willkommen.*

The last one that has come to my attention was a collision between two liners in New York Lower Bay, the aftermost vessel again colliding with the one preceding. That case is more interesting because there was plenty of water, and the vessels were going at half speed, or at about three-quarters speed.*

Of the cases where the vessels were diverted, instead of being mutually attracted, as in the above cases, and no collision resulted, the records do not give us such information; because, in a majority of these cases, nothing happened after the diversion. If there happens to be sea-room, the diverted steamer recovers her course, with plenty of time to do so. Occasionally, there are obstacles in the way, and then happens an accident which brings the matter into the records.

The first one of this type occurred in the early '70s, in Hell Gate. The steamer *Doris* had passed around on the starboard of the tug *Minnie,* having two barges lashed to the beam. The tug

* Compare also a case of *Hawke* and *Olympic,* Southampton, England, September 20, 1911.

was moving very slowly and the steamer attempted to pass. She had full speed on, driving the tug over on the rocks of the Sunken Meadows, so that the outermost barge was sunk.

In 1874 there also occurred a collision in New Haven Harbor between the steamer *C. H. Northam* and a tug hauling a string tow. The tug was hauling three barges abreast and following them two more barges abreast. In that case the suction of the steamer dropped the two farthermost barges astern, so that the tow lines were broken, and the stern-wash fetched them up so as to collide with the forward barges, one of which was sunk.

In 1890 occurred the triple accident between the *Siberia,* the *Ohio* and the *Mather* in the Detroit River. Two of the vessels were going in the same direction, at unequal speeds, the *Siberia* was passed by the *Mather,* and the *Siberia* was diverted from her course to such an extent that before she could recover she collided with the *Ohio.*

The last case on the list is a case so recent that I shall not mention the names of the steamers, the case being still before the courts ; but it is most interesting because of the size of the steamers it concerned, and because of the completeness of the data which we have.

I have one instance here of a third class of suction collisions, and that is in which the suction deflects the vessels when they are passing in opposite directions. The courts have always held that when vessels pass in opposite directions, there is not time for the interaction between the hulls to take effect.

If we turn now to the question of the hydraulic theory, you will find that it is comparatively simple. The only hydraulic principle involved you are already familiar with, and that is the principle of the conservation of energy in a mass of water, whereby the sum of the kinetic head and the static head is a contant, although either is readily convertible, within certain limits into the other.

The hydraulic interaction, of course, is produced and governed by the water-flow from the bow of the stern of each vessel, through a temporarily restricted channel in which pressure variations are set up in order to produce motion. In order to bring that to your attention I have put on this diagram an outline of a venturi meter (Fig. 3). The chief difficulty, I think, encountered in attempting to discuss these matters with laymen is the one which they have in relation to all hydraulic action except that of direct impulse in

the direction of motion of the water. They are constantly looking for the swash of displacement waves (Fig. 2), or the current from a propellor or paddle-wheels and attempt to account for the action by the *direct* impulse of the current of water. So far as I have been able to understand the matter, that has seldom or never anything to do with these accidents. The only case in which that does play a part, so far as I am aware, is in a case where a large vessel leaves a slip—there have been several accidents of that sort—a slip in which barges are moored. In that case the action of the current from the propellers or the paddle-wheels in a restricted area empties the slip of water, and really brings a fair fraction of the thrust of the engines to bear upon any other vessels in the slip, drawing them away from their moorings and leading to later collisions. In that case, it is a very simple affair of direct impulse from the engines. The speed of the vessels is usually almost zero and has nothing to do with it. Those cases are of no guidance in the avoidance of collisions in navigation; they are to be avoided by the use of common sense.

What we have to deal with in all suction cases is to determine, not the forces *alined with* the direction of motion of the water, but the forces *at right angles to* the direction and motion of the ship and the water. That is the point which is hard for the layman to grasp, but you are all of you sufficiently familiar with hydraulics to understand that.

In order to bring out what I have in mind, I have drawn this diagram of the venturi meter (Fig. 3), with the head *A*, the throat *B*, and the outlet *C*. The velocity is comparatively low in entering, and comparatively rapid in the throat. It is then reduced to the original figure at the end. In these diagrams I have used red arrows to indicate velocities and black arrows to indicate forces. There is normally in that conduit, under all velocities, an unlike condition of pressure. As the velocity is increased by the reduction in area at the throat, that static pressure is more or less drawn upon to supply kinetic energy to the water. Ordinarily, it still represents a positive pressure, above atmospheric; but if the dimensions are chosen for the purpose, you can easily have a sub-atmospheric pressure in the throat, shown by the arrows on the outside of the conduit. That is commonly taken advantage of in hydraulic suction-apparatus. The dimensions are made such that there is a distinct deficit of pressure at that point, and then, if it is open

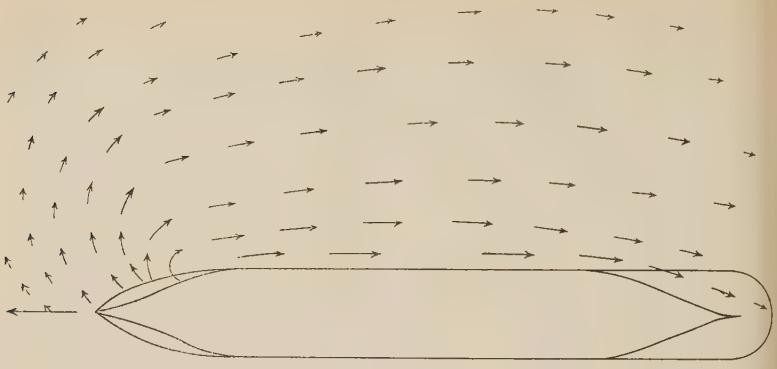


FIG. 1.

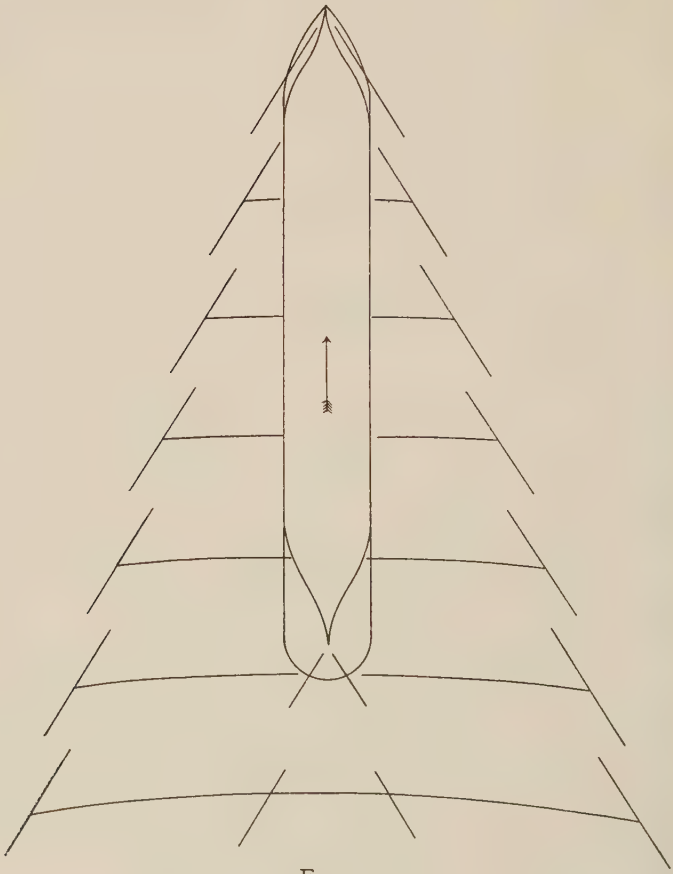


FIG. 2.

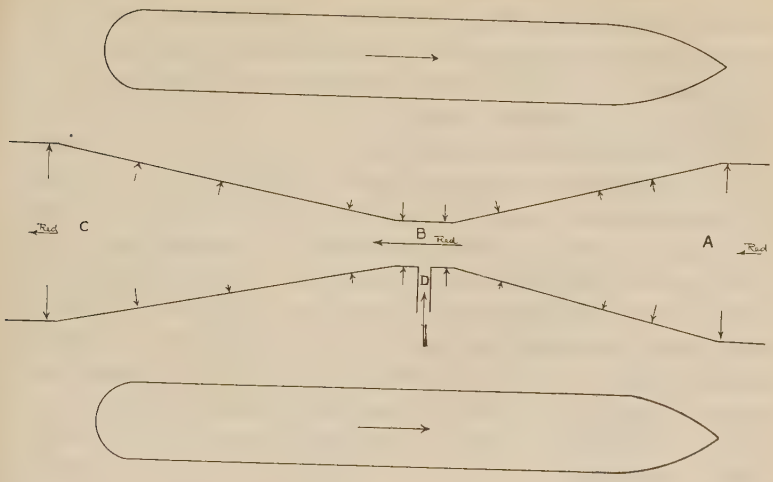


FIG. 3.

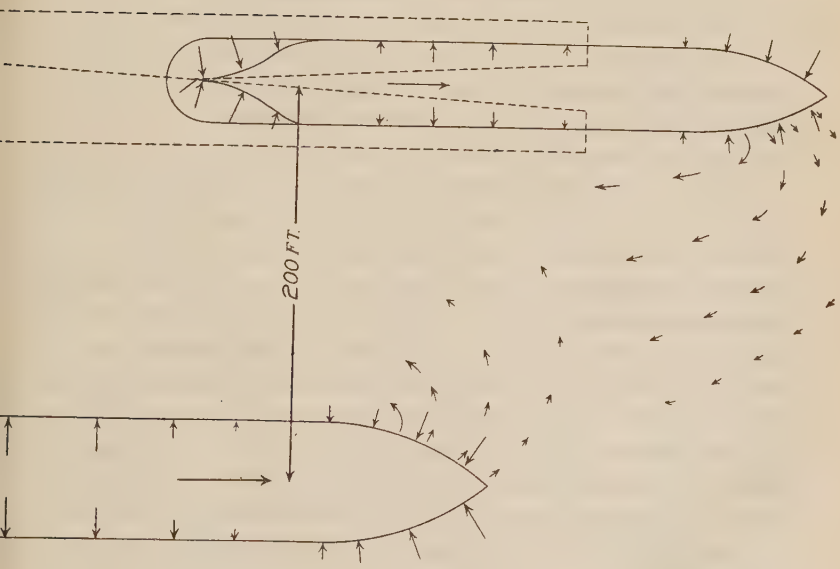


FIG. 4.

here, *D*, there is a condition in which water will be drawn into the throat of the conduit, although the rest of the conduit may be under comparatively heavy pressure. As the water slows down again that kinetic energy again converts itself into static, and we have the regaining of the internal pressure.

In the passage of a vessel through the water, we have, of course, the displacement of water from bow to stern, in order to permit the passage of the vessel. I have here a chart (Fig. 1) in which I will call attention to the displacement of the water, the arrows showing the general direction of the flow. I call attention to the fact that the velocities must be least around the bow of the ship and greater amidships and towards the stern. That is the reason for the practice, in the old sailing ships, of building bluff-bowed vessels. You are well aware that the shape of the stern has a good deal more to do with the speed of the vessel than the sharpness of the bow.

It is those velocities that fall parallel with the axis of the vessel that develop suction between the two ships. If the vessel is in open water, its velocities extend in all directions from the vessel, and of course, theoretically and mathematically, they are inversely as the distance, and so would never become zero. Actually, they are limited to a sensible degree in all vessels. These velocities show the passage of water taking the shortest cut to its destination, except as it develops sufficient resistance.

When two vessels are proceeding in the same direction, the flow on the outer side of either vessel is, of course, normal. But between the two vessels we have action quite similar to the ordinary venturi meter. Here is water between the two stems of the vessel (Fig. 3), and that water has to find its way through this restricted channel between the vessels. Technically, it must have an increased velocity, a positive velocity, which can be determined from the nature and depth of the water, and the distance of the stems apart, and the speed of the vessel. That determines the deficit of pressure amidships. The two hulls of the vessel must develop this deficit of pressure, exactly as do the sides of the conduit of the venturi. That deficit is proportional to the square of the speed of the flow through, and that again depends upon the restriction of the channel.

The flow of water, however, cannot be accomplished without a gathering of initial static head to promote it. That is what

develops the ordinary body-wave of vessels as they move through the water.

In order to avoid confusion, I wish to state clearly that I am not now speaking of the ordinary bow-waves that go off from either bow of a vessel, the waves of natural equilibrium in water as shown in Fig. 2. The bow-wave is dependent upon the speed of the ship only, and, unless the water is very shallow, it is an equilibrium wave. Nor am I referring to the waves that follow after the vessel, in two curved lines (same Fig.), the "echelon" waves. This wave I now refer to is not a natural wave of equilibrium, but (Fig. 8) is a constrained wave; it is not a true wave at all. It is a conformation of the surface of the water, enforced upon the water by the constraint of the ship, the bottom and the pressure effect. The theory of waves may be said not to apply to this phenomenon at all. This constrained wave, as I have called it, consists in a surplus of pressure above average mean sea-level at this point *A*, (Fig. 8 and 8a), which must be accomplished in order to set the water into motion. So here at *A*, we have water pushed ahead of the vessel, and rising as it is pushed—and that represents, by the way, the cross-section of a wave which extends in a fairly straight line, laterally. On river steamers you get the best chance to observe that. I have noticed it in the upper Hudson, where the reaches are fairly restricted. Standing in the bow, and looking ahead along the shore, you can see the surplus or excess following along either shore, away ahead of the vessel. The water is pushed ahead for quite a distance. The height is very little, but the tonnage of water moved is very great.

The principle of ordinary static equilibrium insures the fact that at the point of maximum velocity the level must be lower than mean sea-level. Therefore at that point (*B*, Fig. 8) we have water moving at minimum velocity. Here (*C*, Fig. 8) we have water moving at maximum velocity. Here (*D*, Fig. 8) the water is comparatively at rest; but because the equilibrium has once been disturbed, it does not come back to its original position. Then are developed the natural waves which follow after the vessel, the "echelon" waves, the length of which depends upon their speed.

This diagram (Fig. 3) represents one of the positions of unstable equilibrium, the suction-position when two vessels, going in the same direction, have come to this point. The forces then are nearly equal to the surplus pressure outside either ship, and are

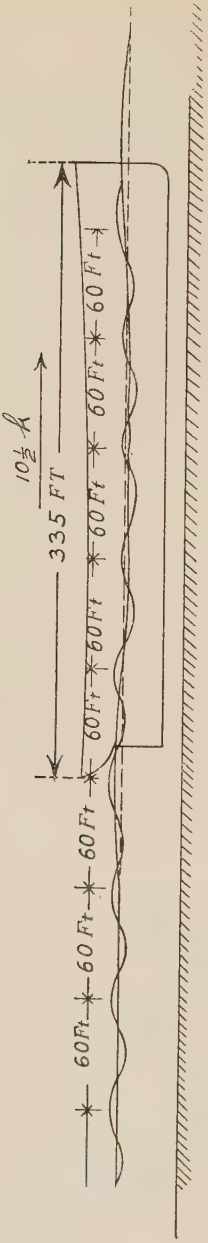

10½ λ
335 FT
60 Ft
60 Ft
60 Ft
60 Ft
60 Ft
60 Ft
60 Ft
60 Ft
60 Ft

FIG. 5.

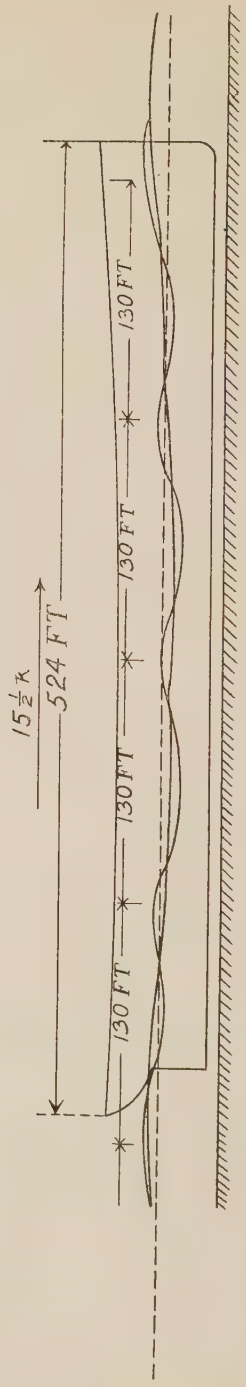

15½ λ
524 FT
130 FT
130 FT
130 FT
130 FT

FIG 6.

drawing the ships bodily together. Since ships do not move easily sideways through the water, that particular phase of the situation very seldom has any real effect. Ships sailing side by side are not often brought bodily together, parallel with each other. The only interest in looking at this diagram is that it shows an intermediate phase between the two dangerous phases. That is the case where

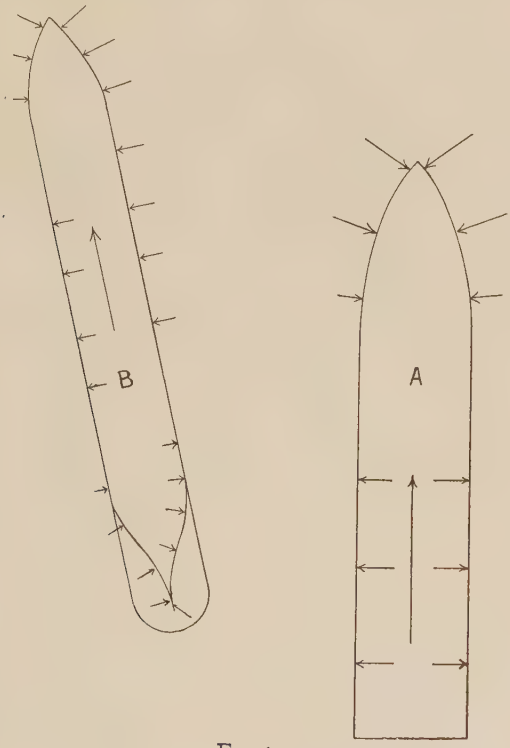


FIG. 7.

vessels are of equal length, where their bow-waves are in phase with each other.

The trouble is passing vessels comes, however, when the waves are out of phase—when the stern-waves are out of phase—with crest to trough, and trough to crest.

I have here a diagram, drawn to scale, of one of the liners in this most recent collision (Fig. 8a), on the same scale as this diagram (Fig. 8). This is the slower vessel being overtaken (Fig. 8), and this the larger vessel (Fig. 8a). If I place these diagrams

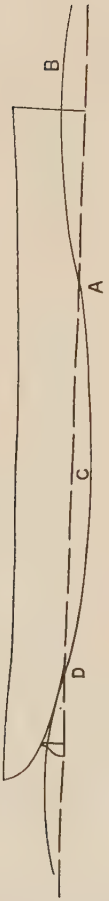


FIG. 8.

FIG. 8A.

one over the other in this way (Figs. 8 and 8a), the water-lines coincide. That shows the first phase of a larger vessel, the faster vessel, overtaking a smaller vessel. The two crests coincide in this case, consequently the crests are intensified. The two vessels would be repelled one from the other by the accumulation of surplus pressure in between. That phase very seldom produces any dangerous effect.

If we slide the diagram 8a along until we come to this position (*D*, of Fig. 8, opposite *C*, of Fig. 8a), we get the first dangerous phase. We now have the crest of the stern-wave of the overtaken vessel abreast the trough of the wave of the overtaking vessel. The result is a dropping away of the pressure on the port bow of the faster vessel, and a surplus pressure on the starboard beam of the slower vessel. These two forces very seldom have any effect. The overtaking vessel is usually the larger, and also the longer vessel. Her tonnage and her moment of gyration about the horizontal axis are much greater than that of the smaller vessel. So the larger vessel is very seldom affected.

The smaller vessel, on the other hand, is affected amidships; the force acting on her has a tendency to draw her bodily sideways through the water to the larger vessel. That, of course, cannot have any appreciable effect. At the stern, however, we find that the stern-surplus of the smaller vessel has offset the natural deficit in lateral force amidships of the overtaking vessel. That cannot affect the overtaking vessel, because it is a force amidships. But on the smaller vessel it makes trouble. This force pulls the water away from the starboard quarter of the overtaken vessel, and sheers her stern in toward the overtaken vessel, and that sends the bow out correspondingly.

That leads to the first class of suction-action, the repulsion of the overtaken vessel. If the vessels continued in that position, and were near enough together, this vessel (Fig. 8) would be driven off to port, and would not ordinarily recover.

In fact, I might explain that the only state of stable hydraulic equilibrium for two vessels passing in this way is when they are at right angles to each other. In other words, this smaller vessel is not in stable equilibrium until it finds itself in the trough of these stern waves, athwart its original course. I heard one pilot tesify to being in charge of a steamer going down New York Bay, when he was passed by a larger liner; and he was diverted in that

way. Fortunately, he had plenty of sea-room, and it was only necessary to reverse his engines; but by the time the ship was stopped she was out eight points from her original course, right across the channel, and the other vessel had gone on. There was nothing for him to do but work his ship around again. That is, to say, equilibrium is obtained, and the suction-forces cease entirely only when the ships are at right angles.

If we advance these overlapping vessels to the next position (Figs. 8a and 8), we find here the counterpart of this diagram (Fig. 3). This position develops the most serious condition of all; that is, when the point *B* of the overtaken vessel comes opposite this point *C* of the overtaking vessel. That, of course, draws water on the port beam of the larger vessel. But this force can have no effect because it acts amidships, and because the vessel is so large; but it does draw the water away from the starboard bow of the overtaken vessel, and gives her a sheer toward the larger vessel. That gives rise to the worst possible state of affairs; because, if, in Fig. 3, instead of drawing the ships in parallel position, we should give either or both of them a slight sheer toward each other, you can see that we would very much restrict the area of cross section in proportion to the volume of water passed through. The most restricted area would not be amidship, but near the bow, and, being near the bow, is would create a deficit of pressure between the two vessels, and sheer them still further together.

We would therefore again have unstable equilibrium, the instability of which is increasing very rapidly (instead of decreasing as in the case of the diverted vessel), and which must inevitably lead to collision. The movement of the two vessels toward each other multiplies the force, and the force multiplies the motion. Matters are accelerated in geometric progression. There is not time to do anything. The force very quickly becomes uncontrollable.

Such an action as that— if we suppose this to be the overtaking vessel (Fig. 8a)—would occur when the vessel of Fig. 8a had its beam about opposite the bow of that of Fig. 8; and the instant the vessel of Fig. 8 begins to sheer, she throws off her own water from her bow, and sheers more and more, and usually gives a plunge into the other vessel, striking abaft the beam. To make sure that I make myself plain, I will imagine the vessel of Fig. 8a

to have reached the position with *C*, of Fig. 8, opposite *B*, of Fig. 8a, and by the time she has got there the vessel of Fig. 8 has sheered over and has struck at *D*, Fig. 8a. That is the commonest instance of suction-collision.

Here I have drawn a diagram of a vessel being diverted (Fig. 7). You can follow the venturi action, the water between these two stems developing an increased force on the beam of the vessel *A*, and on the quarter of *B*. The forces set up there—I have drawn the vessel with the helm hard a-port—are such as could not be overcome by any reverse helm action whatever, particularly as the reverse action is attempting to deflect water which has already been deflected in that direction.

That condition of unstable equilibrium is apparently a very complex one. It not only has to do with the constrained waves, but is frequently complicated by the natural waves of the vessel, so that the vessels would pass through two or more phases of unstable equilibrium. That is particularly true when one vessel is considerably longer than the other, so that the body waves of one are longer than those of the other.

This diagram is also drawn to scale (Fig. 6). That is to show, in the first place, the very scant water in which large liners find themselves in the channels of our harbors. There is almost no passageway for water beneath the vessels. There is some space there, but it is of very little use for transmission of water, and practically all the water has to find its way around one side or the other.

These figures show that sixty feet was the natural length of the wave for a boat of this type (Fig. 5). The vessel of Fig. 6, however, has a natural wave length of 130 feet, so that the echelon waves which combine are about two to one. In the large vessels shown that did not have any particular effect. But, in the case of a small vessel like a tug, it would. For instance, the tug *Hartt* was of about the right length to reach from one crest to the next crest of the natural wave of the *City of Brockton*, so that the tug was affected not only by the constrained wave, but also at the point where the crest of the natural wave came along. That is the natural explanation why the tug took a sheer toward the *Brockton* and then straightened up, and then, as the second crest came, took her second plunge and ran into the port paddle-box.

That primary and secondary sheer occurs in a number of these cases, and that is the natural explanation. We might possibly go into it mathematically, but we should not get a much clearer idea; because the one thing we cannot get in suction-cases is quantitative results, or exact data. In the first place, the position of vessels can never be established correctly. Whenever a collision does occur it means that the positions change so very rapidly that the exact point is almost impossible of discovery, so that we get no exact data whatever.

It has, however, brought out one interesting thing, which is that the ordinary seafaring man, even of the best class, is quite incapable of estimating distances over water in yards or feet. He handles his vessel by eye and judgment, in reference to direction and distance, from a light or buoy. But when it comes to translating that into feet, it is pretty hard for him to go into court and tell the exact position of the vessel.

In a case shown on these diagrams, one of the vessels was one of the most prominent liners leaving New York. Her commander came on the stand and testified about her course down New York Bay, and as he did so I charted his testimony. But if his ship had been where he said it was, she would have been dragging mud all the way down the bay. And that is not anything unnatural. It is usually safe, and is the common practice of the court, to take a point half way between the testimony of the two sides as nearest the probable truth; but in no case is the data exact.

The only exact investigation work to determine the effects of suction-action has been done by Naval Constructor Taylor, and I have had some of his charts reproduced here to show how his experimental work verifies the theory of the matter. (See Vol. 17, 1909, *Transactions Am. Soc. Nav. Archts. & Marine Engrs.*)

Mr. Taylor made his experiments in a tank with two models, each about twenty feet long, and each having the same displacement of 3000 pounds and, with different lines for the midship across section in special cases. These diagrams (Plates 2, 3, 4, 5), show the results he got.

The little arrows show the deflecting forces which he measured. In these experiments the vessels were fixed in their courses, and held in position, and were moved in the direction parallel to each other. The deflecting forces could not set up any sheer, of course. They were measured in the initial stage of suction only.

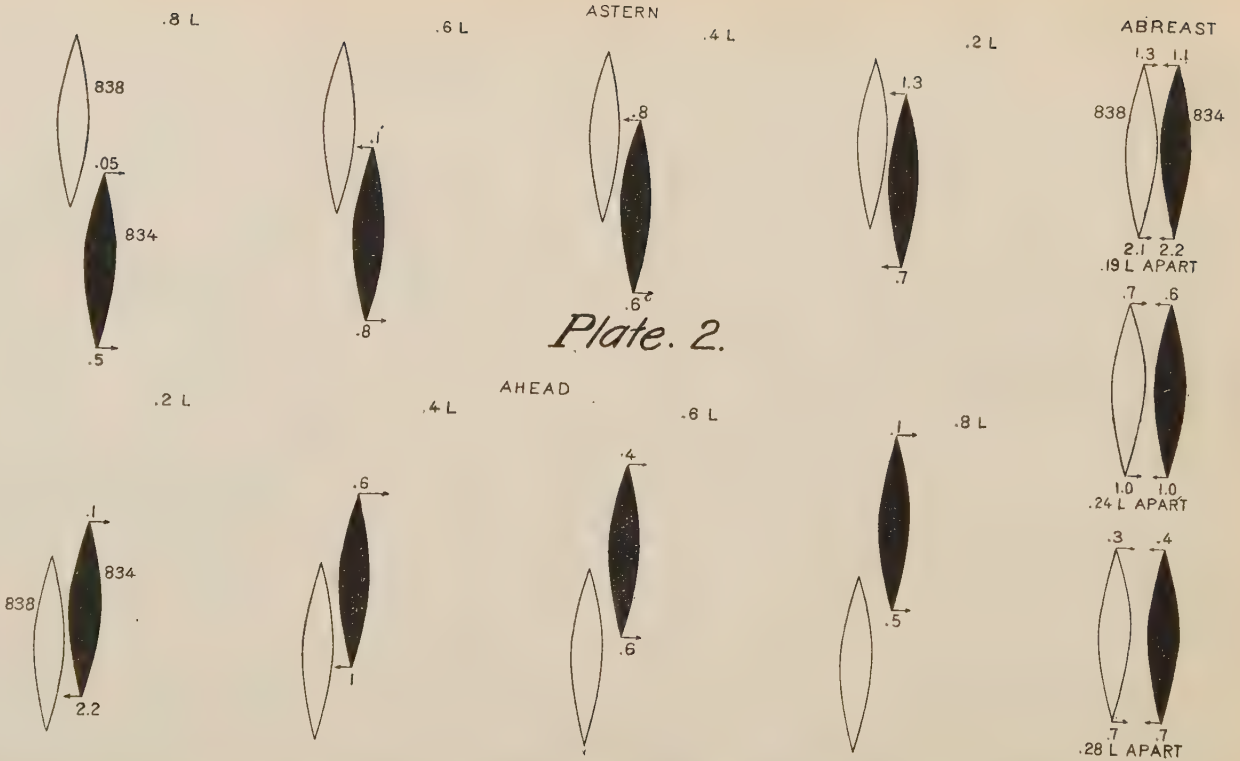
These diagrams show the distance between the two vessels. Here the two vessels are far apart, and the forces are .7 at the stern (lower R. H. diagram, Pl. 2), and .3 and .4 at the bow. The fractions are the deflecting forces, expressed as ratios in terms of the resistance.

Here (middle R. H. diagram, Pl. 2) the models were .24 of their length apart, and the stern forces have been increased to unity. Those of .3 and .4 increased to .6 and .7. Here (upper R. H. diagram Pl. 2) they are brought within .19 of their length and the deflecting forces have risen to 1.3 and 1.1 at the bow and 2.1 and 2.2 at the stern.

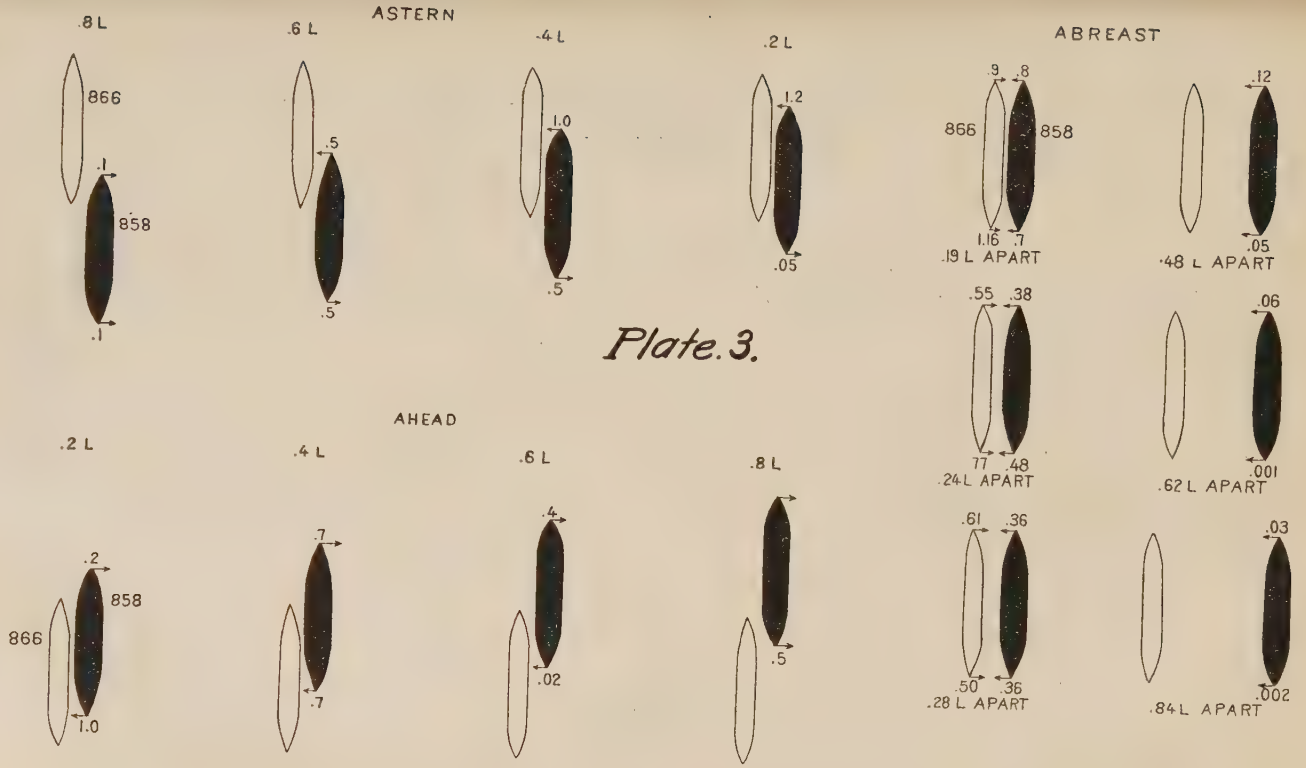
Mr. Taylor placed the hulls so close together that the water in the tank was quite deep, comparatively, in relation to the size of the models. Here are his experiments with another pair of models having fuller lines, showing the same thing, Pl. 3. At seven-eighths of their length apart the forces are very slight, .002 at the stern and .03 at the bow (lower R. H. diagram, Pl. 3). Those forces are so slight that they probably do not mean very much. In the upper R. H. diagram, Pl. 3, the distance apart is one-half of the length, and the forces have risen to about .05 and .12. In second set from right, Pl. 3, are the full line models at distances apart which correspond to those of the fine line models of Pl. 2, with corresponding figures.

These diagrams (Pl. 4 and Pl. 5) show the effect of these forces in the form of curves. Mr. Taylor has taken all of his results in terms of the overtaking vessels. I think that is misleading, because it is only in unusual cases that the overtaking vessel is affected; it is nearly always with the overtaken vessel. He explains, as to this, that the names might be interchanged, and it would simply mean a rearrangement of the diagrams. Not until the position is reached shown in upper .6, .4 and .2*L* diagram, Pl. 3, do we find the repulsion at work on the stern, and attraction on the bow. Out here (upper middle diagram, Pl. 3) the bow is under repulsion. An interesting thing appears with the stern under strong repulsion, when the vessels are practically clear of each other (lower .6*L* diagram Pl. 3).

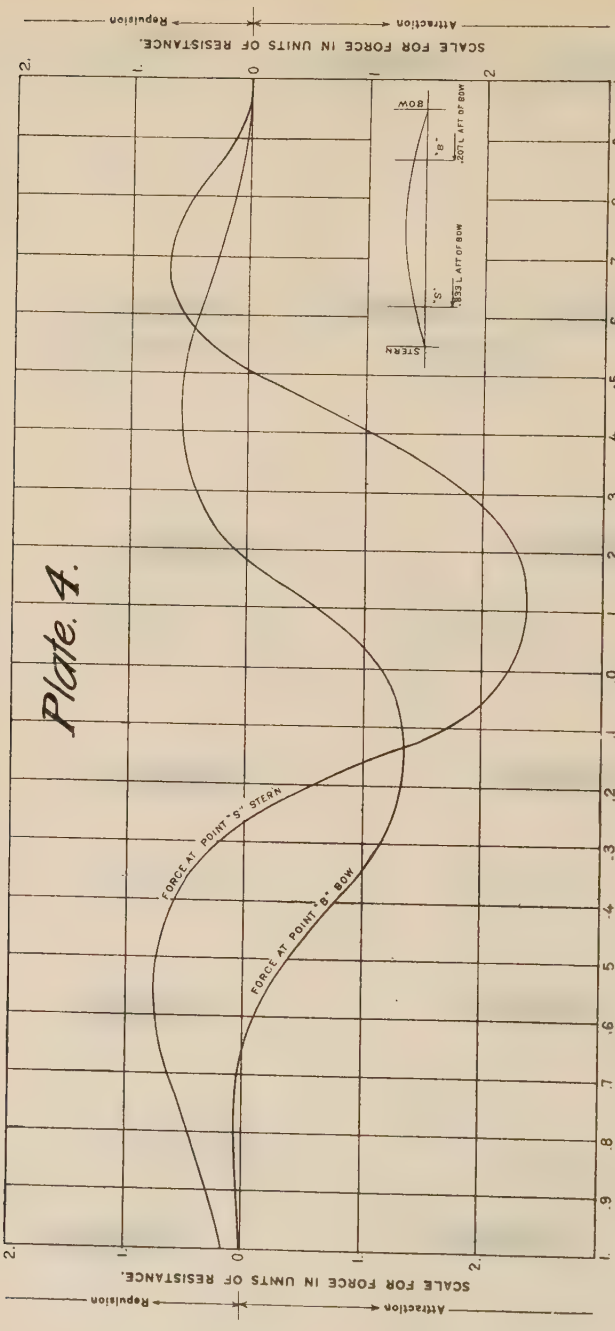
In the positions shown in lower .2, .4 and .6*L* diagram, Pl. 3, the overtaking vessel has passed and is in the lead, and the forces which then act on the two vessels are clearly indicated. None of these diagrams show how rapidly the forces must increase as the vessels sheer toward one another.



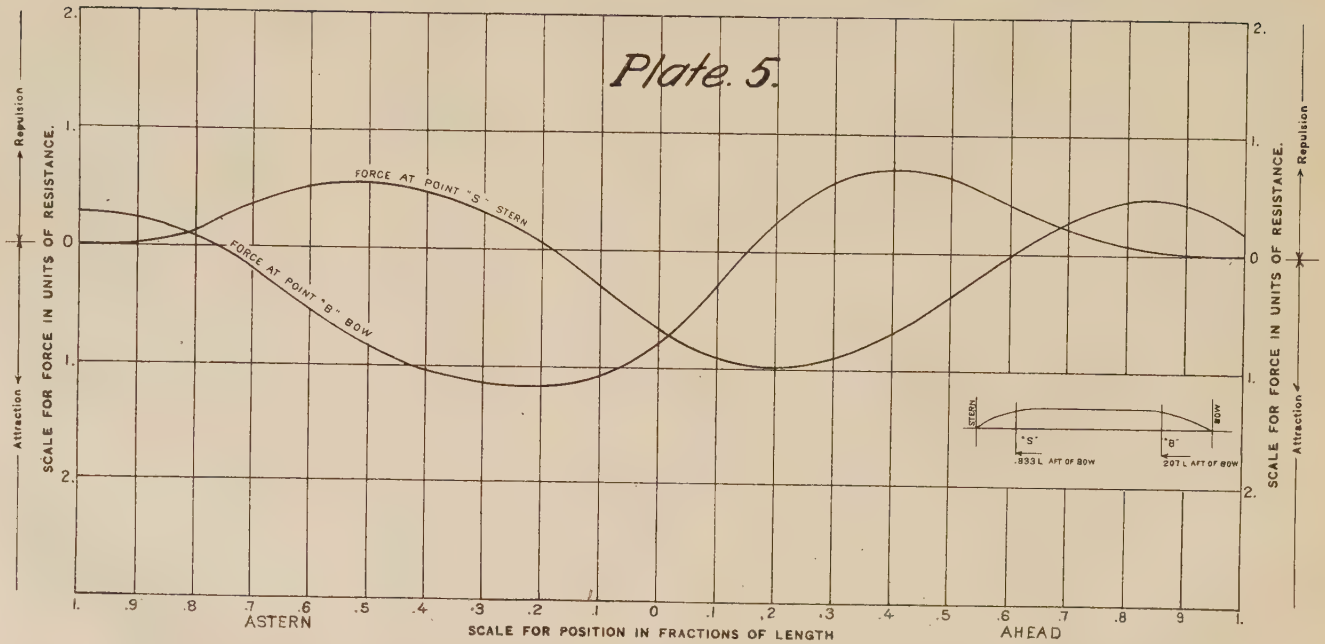
FORCES UPON MODEL 834 WHEN PASSING MODEL 838. THE ARROWS SHOW THE DIRECTIONS OF THE FORWARD AND AFTER FORCES. THE FIGURES SHOW THE AMOUNTS EXPRESSED AS FRACTIONS OF THE TOTAL RESISTANCE. SPEED OF MODELS, 2 TO 3 KNOTS.



Forces upon Model 858 when Passing Model 866. The Arrows Show the Directions of the Forward and After Forces. The Figures Show the Amounts Expressed as Fractions of the Total Resistance. Speed of Models, 2 to 3 Knots.



FORCES FORWARD AND AFT, ACTING UPON MODEL, 834 WHEN PASSING MODEL 838, EXPRESSED AS FRACTIONS OF THE TOTAL RESISTANCE. DISTANCE OF CENTER LINES APART, 3.90 FEET. SPEED, 2 TO 3 KNOTS.



FORCES FORWARD AND AFT, ACTING UPON MODEL 858 WHEN PASSING MODEL 866, EXPRESSED AS FRACTIONS OF THE TOTAL RESISTANCE. DISTANCE OF CENTER LINES APART, 3.90 FEET. SPEED, 2 TO 3 KNOTS.

The diagram of Pl. 4 suggests the same result in another way. The figures on the base-line show the relative position of the two vessels, the two vessels being initially just beginning to overlap. The ordinates are repulsion above and attraction below. As the vessels come abreast there is a turning-moment or tendency to sheer the vessel from its original course, and that tendency is proportional to the distance between the two curves. When we get to the point shown by ordinate .1 ahead, we get a maximum moment of sheer. The result of that moment is the deflection of the vessel, but if there is plenty of sea-room, there can be no harm.

The diagram of Pl. 5 is the corresponding one for two other models. They show the same thing, except in the diminution of the forces, and give corresponding results. You will notice that there is considerable difference between this curve and the one we just examined, although the models are being towed at the same speed, in the same water and at the same distance apart, showing that the lines of the vessel have a good deal to do with it. It is some such effect as that which makes it hard to predict whether a suction-collision is going to take place or not. We have not yet reduced this to numerical form. At the points on these curves shown at .4 astern the moment tending to bring them into collision is much greater than elsewhere, and would make the danger of collision much greater, although an almost equal deflective effect is shown at .4 ahead.

I shall not attempt to bring Mr. Taylor's findings into any concise mathematical laws, but I think it is important to point out that the experimental data, so far as they go, corroborate the simple theory of the matter. So I have taken the figures of Mr. Taylor's experiments and tried to draw a few simple deductions from them.

The thing of primary interest is the distance apart of the two vessels. That, of course, is what every navigator wants to know, how closely he may approach with safety. There again, we cannot give any exact statement to cover all cases; all we can say is that whenever you get in what is known as a suction-position your vessel will be in unstable equilibrium, and you must look out.

However, in following this theory (Fig. 3 of lecture) the deflecting forces ought to be proportional to the ratio between the water trapped between the stems and the area of the passage-way in the center. Let B represent the distance from stem to stem, D

the distance between the rails amidships, S the deflecting force at the stern in terms of the resistance of the vessel and A a coefficient; then the deflecting force would be proportional to the square root of B over D minus one.

$$S = \text{deflecting force} = A \sqrt{\frac{B}{D}} - 1.$$

If I attempt to get a coefficient for A of that expression it will give me some sort of mathematical relationship for the thing. I find from Mr. Taylor's experiments given in Pl. 2 that the values for A lie between 0.787, 0.952 and 0.783; and from the first three experiments of the second set (Pl. 3) I find the figures 0.662, 0.613 and 0.625. That means that these values fall fairly near together. They are in rough agreement, and I draw the inference from that that the value of A is from 0.6 to 0.8 for those models, under varying distances apart. Whether that would have a corresponding value for different models of larger vessels, we have no data at all. It is worth while to say that the matter is consistent and harmonious.

If we abandon that theory and go upon the assumption that you merely find the numerical relationship between results, we find that we can state roughly that when the distance apart between rails is stated as a fraction D of the length, and the total attraction at bow and stern together is stated as a fraction of the resistance we have

$$A = \frac{C}{100D^3}.$$

wherein the constant C has a value between 1 and 2. That is purely an abitrary relationship, but that will give some sort of an idea. A applies, of course, only to models 20 feet long, abreast, moving at 2 to 3 knots, the equivalent of ships 400 feet long, abreast, moving at 9 to 14 knots, in deep water.

Now, again, if we compare the results between these two sets of models, one of full lines and the other of finer lines, we should see from diagram such as this that the effect must be proportional to the water displaced. If we take the ratio between the aggregate midship cross-section for the two models of Pl. 2, and that of the models of Pl. 3, towed abreast, we find that ratio to be 1.27. If we take a similar ratio between the maximum suction-moments of the respective cases, we find that to be 1.20 That also confirms us in the idea that the explanation which is drawn from the theo-

retical basis is about correct, and we find that the experimental results, so far, are in consonance with that.

I think it will be interesting to go over some of these actual collision cases and see how they follow out our ideas. The first one on the list is the collision of two Sound steamers at Hell Gate, but we have no data in regard to them which we may discuss. The interesting thing to note is how a slower vessel hung on to a faster vessel and was carried up East River by this hydraulic interaction. That position is one of unstable equilibrium. It is exactly the same thing as a sailing vessel running before a gale, on a high sea. If the commander has that in mind it can be avoided, as a rule; it is a dangerous position, and the slightest lapse of care will lead to serious results. She is not in equilibrium until she is fairly in the trough of the sea; after she has come to a stop she can be gotten on her course again.

The next one was of chief interest because it was the first instance of a primary and secondary sheer and collision between vessels of different dimensions. The next one, the *Imperial* and the *Garden City* collision, occurred some thirty years ago near the western shore of the East River, quite close to pier 54 (see chart, New York Harbor), when the ebb tide was coming out. The tug *Imperial* was running up quite close to the wharves and the ferry-boat *Garden City* overtook her. The vessels were close together, in deep water. That case was confused by two contributing causes. The courses were slightly converging, and there was a tidal eddy, which would give the tug a sheer toward the *Garden City*. For that reason the court did not discuss any question of suction-sheer as a primary cause. But to my mind, because the courses were converging, and the distances were very restricted (I think there was only some 50 feet between two rails), the probabilities of suction were very great.

The next case is a larger and more important case, that of the *Aurania* and *Republic*, two large liners leaving New York. Your familiarity with the charts will enable you to follow the argument. (See chart, New York Lower Bay, lower main ship channel, lower Swash Channel, out past the Hook and past South Channel, and turning into Gedney Channel). Large vessels coming that way have to make a turn of about four points to get in through the channel, and the width of the channel is restricted for large vessels. There have been two collisions at the entrance to Gedney Chan-

nel, under identical conditions. The *Aurania,* the faster vessel, passed the *Republic* well up in the Upper Bay and came down in the Lower Bay ahead. She had to take the Horseshoe Channel, whereas the Republic got through the Swash Channel and came out ahead. The *Aurania* overtook the *Republic* after they had begun to make the turn in the Gedney Channel. We will find that the mean depth to the westward of the buoy runs about 40 feet; just at the turn that shoals quite suddenly to 30 feet. A restriction of depth of water of 10 or 11 feet, when the ground was only 15 feet below the bottom of the ship anyway, is equivalent to a very sudden diminution of throat-area in the venturi meter. That is always a dangerous case, for this reason: The natural speed is less in shallow water than in deep water, and when the ship runs from deep into shallow water the kinetic energy stored in the entire hull converts itself into suction-energy. She runs into a condition which will be very quickly seen to be dangerous.

In cases like this the causes producing the suction-conditions which I have described could not be very well anticipated. The energy which was contributed to deflecting the vessels would be the momentum-energy of the two hulls. The speed would be changed suddenly from the natural speed in deep water to the natural speed in shallow water. The kinetic energy between these two speeds would be converted suddenly into a constrained wave outside the ship. That gives rise to unstable equilibrium of the worst sort.

I may say here that the chance incident which drew me into the whole line of this discussion was that I happened to see something in the daily press about one of these collisions that occurred in the Gedney Channel, and I thought we might get some interesting data if we could place the vessels accurately at that point.

One other collision quite similar to this was that between the *Mesaba* and the *Martello,* which occurred in 1900, in the same place, and almost in the same way.

The collision, or rather the encounter, between the two large vessels represented to scale in the diagrams I have shown, the most recent one that occurred, was just at the mouth of the Swash Channel, going down the Lower Bay. The vessel overtaken was on the easterly side of the channel. Just before she reached the mouth of the Swash Channel she was overtaken by the larger vessel. The larger vessel caused the smaller vessel to sheer to the

eastward quite a good deal. When the captain of the larger vessel reached the other side at the end of his trip he was very much surprised to find that his own vessel had been libeled for having forced the other vessel ashore.

The general depth in mid-channel in this case is fairly even; but there was a shoal spot at just about the place where the collision occurred, and I should say, in passing, that we might locate the collision at about that spot in the shoal. We were not able to get sufficiently exact data to do this with certainty, however.

In contradistinction to that idea there were two cases in New York Upper Bay, where the water is from 70 to 90 feet deep, and where the vessels were not going at full speed. That shows that suction-action may occur where the water is of considerable depth.

Of the deflections, except for this one I mentioned, I will describe only one. This is a collision on the Delaware River, just below Newcastle, (Southwest Range, see chart, Delaware River, with a shoal, pretty close to the range). A vessel coming down was passed by a vessel, overtaken itself by the *Willkommen*, which was overtaken by the *Aureole*. After the *Aureole* had almost passed, the *Willkommen* was drawn in, and there was a collision upon the port quarter. The *Willkommen's* engines were first slowed and then stopped. Whether that helped or harmed, we cannot say. It is the most natural impulse to shut off power. But the point is, that whereas the depth along the channel is four fathoms, the depth on the outer sides is three and three quarters, and three and a half; and the *Willkommen* naturally went toward the west to give the *Aureole* a chance to get through easily without running into shoal water. These boats were both drawing about tyenty-four feet, and there must have been five or six feet of tide above the plane of reference, so that there was inshore about 27 feet, and further out about 30 feet.

The case of the *Ohio* (Fig. 9) was in the Detroit River. There was plenty of water sideways, but not so very much underneath. In that case the *Mather* overtook the *Siberia*, going in the same direction; the *Siberia* sheered to port, under influence of suction, ran off and collided with the *Ohio*, which was coming down in the opposite direction. That is one of the combinations that must be looked out for. There is a good rule in the west that if you meet two men coming down the pike, never let them pass on both sides

of you at once, and it might be the same way in connection with vessels passing.

The only other case I shall speak of at all is that of two vessels passing in opposite directions (Fig. 10). This was the case of the steamer *Devereaux,* coming down Lake George, St. Mary's River. There was a wide dredged channel which was restricted at a certain point by a natural restricted channel, and then a dredged channel on beyond. The *Devereaux* coming down passed the tug

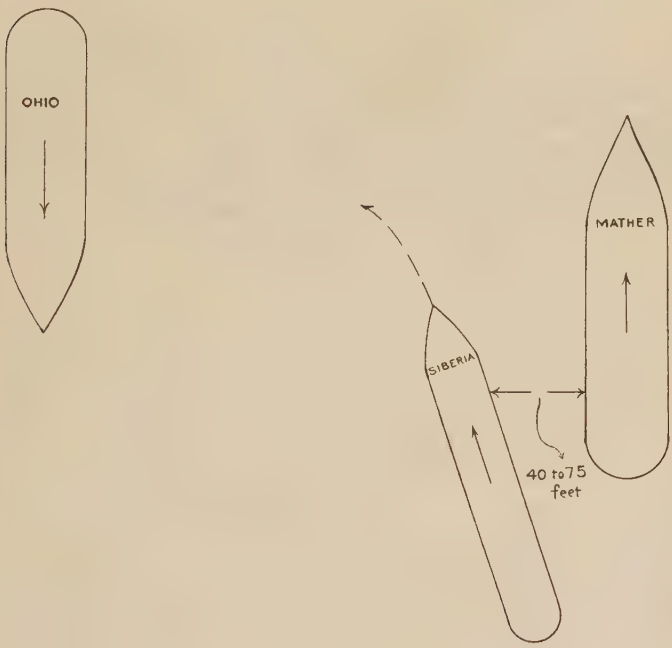


FIG. 9.

Folsom towing the schooner *Mitchell.* When the *Devereaux* got opposite the *Folsom* she took a sheer and came into collision with the *Mitchell,* breaking the tow line and driving her ashore. I have sketched out the dimensions to scale with the cross sections drawn to scale also. The *Devereaux* is drawn in the position where the court assigned her, but that does not seem quite correct. At any rate she was over near the bank. A vessel near a bank like that is spoken of by the pilots as "smelling the bank." She is deflected from her course, and it is altogether likely that that was the

beginning of the phenomena there. The vessels were so close together that I feel quite sure, particularly in view of the position of the *Devereaux* when she sheered, that suction there was a contributing cause of the collision.

The conclusion which I have tried to draw from this is that we ought to have a better recognition of the subject. We ought to have more data to work with in this matter of collision between vessels. What I have said is all very plausible, but how far it

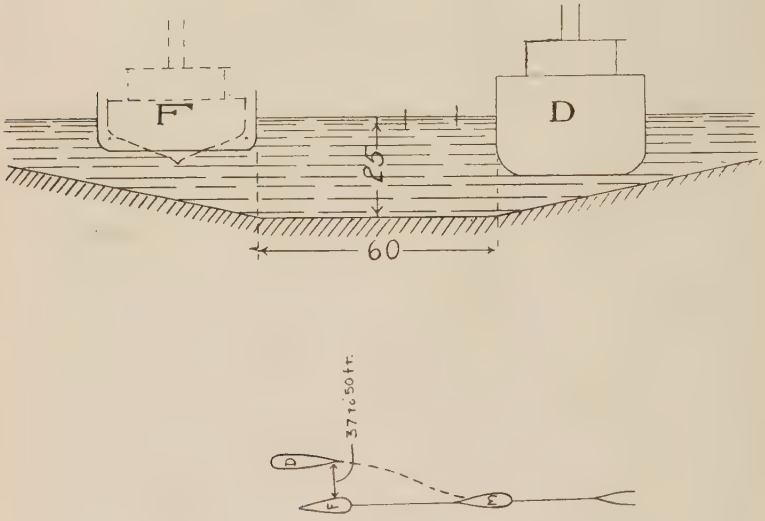


FIG. 10.

Devereaux—Mitchell Case.
Devereaux—Steamer, 270 ft. long, 37 ft. beam, 15 ft. draft, speed, 4 miles.
Mitchell—Schooner, 212 ft. long, 40 ft. beam, in tow, on 500 ft. line, of
Folsom—Tug, 180 ft. long, 35 ft. beam, $\left\{ \begin{matrix} 3 \\ 11 \end{matrix} \right\}$ ft. draft, speed less than 5 miles.
Displacement of D about 4 times that of F.
After collision, D passed within 30 ft. of another steamer without deflection of course.

would be justified by experience extended to a large number of cases of different dimensions is not certain. From these I cannot give you any quantitative rules as to how near vessels may approach and at what speed.

We ought to have a definite rule to cover such cases, particularly as steamers are getting larger and the channels are not changing;

the dredged channels are multiplying; they are no smaller, but vessels are getting larger and the channels are not, so that suction cases appear to be on the increase. It would not necessarily be an international rule, because these forces occur only in restricted waters, and each country could enforce its own rule, though the rule ought to be international and uniform. I am not a pilot at all, and I would not suggest what that rule should be, except that when an overtaking vessel signals for permission to pass a slower vessel it should be within the power of the overtaken vessel to signal, "I am slowing my engines; I fear danger," and that should enforce upon the larger and faster vessel the slowing of her engines also. I think, in all these cases that I have considered, if both vessels had been at half speed the collisions could have been avoided. It does not do any good for the overtaken vessel to slow her engines if the overtaking vessel passes at full speed.

Extracts from a Letter of Mr. Reeve, Dated November, 11, 1911.

So soon as I get into the work on the problems connected with suction I feel the need for more data. At the same time I am impressed with the realization of what a splendid machine for the collection of data the U. S. Navy might be, without expense, if directed somewhat to that end.

For instance, two items about which we need data is the thickness of the layer of eddies along the ship's skin, and the outline of the water-level along her side, both observed when the ship is under way at different speeds—or even at her standard speed only.

The midship cross-section of the hull effective for fore and aft displacement of water, as you well know, is greater than that of the metal itself, by a layer of eddies which are dragged along by the ship; but I have not yet run across any data as to the thickness of this layer, amounting to a foot or more, I should judge, on fast vessels, although it is easily observable over the side.

The distance at which suction-effect could be felt, transversely to the ship's course, could be known, if we had data as to the height of displacement-wave, at bow, mid-length and at stern, usual in vessels of her size and speed. But I have seen no collection of such data.

Indeed, the Department may already possess such data about its ships, of which I am not informed. I must go to Washington when I get this work a little further along, to look up a number of such things. If you have any suggestions as to where data may be found I should be grateful for references.

Yours very sincerely,

SIDNEY A. REEVE.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

COLLISION BETWEEN H. M. S. *HAWKE* AND R. M. S. *OLYMPIC*.

By Lieutenant W. C. Nixon, U. S. Navy.

As a matter of general interest to the service at large, and as an additional note to the lecture delivered before the School of Marine Engineering by Mr. Sydney A. Reeve on the "Hydraulic Interaction Between Ships," I have prepared the following notes on the collision between H. M. S. *Hawke* and R. M. S. *Olympic*, on September 20, 1911, off Cowes, Isle of Wight.

These notes are the result of my personal observations while a passenger on the Olympic, and cover the situation from its earliest stages to the actual collision, I having had an excellent opportunity of watching the accident from a position on the starboard side of the promenade deck of the *Olympic*.

At the time of his lecture, Mr. Reeve's statements were to me more or less startling and revolutionary, as I believe they were to nearly all those officers who heard them. Prior to this lecture, in common with many officers to whom I have since talked, I had a vague impression that "suction," as a term used to account for any interaction between passing ships, was purely a propeller "suction." To a certain extent, I had frequently observed such interaction between small vessels, such as torpedo boats and destroyers, and had learned that under certain conditions such action must be expected and allowed for, but I had always accounted for it by such vague terms as "shallow water," "high speed," "suction," etc. For some five months following the date of the lecture, no opportunity of further observation presented itself, but when the situation arose between the *Hawke* and the *Olympic*, it was instantly apparent that it was one of the rare examples of the "ideal" case assumed by Mr. Reeve; and following his system of reasoning I was able to anticipate nearly all phases of the collision.

I came up on the starboard side of the promenade deck of the *Olympic* at the instant when she blew two blasts on her whistle, to indicate her turn into the channel leading to the left of the Isle of Wight. The situation at this moment is indicated in the sketch marked Fig. 1, on opposite page.

Olympic following the channel from Southampton Water to sea, about ½ to 1 mile from the intersection of this channel with the one from the Solent. At this intersection the two channels unite into the main channel past the Isle of Wight. Upon her arrival at the point of intersection, the *Olympic* must make approximately a six point turn to port.

Hawke coming up the channel from the Solent, about the same distance from the intersection as the *Olympic,* and rather more than that from the *Olympic* herself.

Speed.—While it is difficult for me to judge the speed of the *Olympic* on account of the height of her decks above the water, all circumstances, such as time and distance from the dock at Southampton, speed with which objects passed, and the sound of the engines, lead me to believe that the *Olympic* was making at least 15 knots and probably her speed was nearer 18 knots.

It is worthy of mention that the usual course of liners leaving Southampton for Cherbourg is to pass to the starboard side of the Isle of Wight, that is, to turn to the right at the junction of the channels from the Solent and Southampton Water, and to pass to sea through the Solent. Hence there may have been some confusion in the mind of the captain of the *Hawke* as to the exact meaning of the Olympic's two blasts.

While in this situation the *Olympic* blew two blasts, and as far as I could learn held her speed. I am not certain whether the *Hawke* paid any attention or made any acknowledgment to these blasts, and apparently she too was holding her speed. As both vessels approached the main channel, it was evident that the *Olympic* would turn first by a slight margin, and as the *Hawke* kept coming on I recall wondering if her commanding officer understood "suction" and appreciated the danger he was running into. While yet a quarter of a mile away, however, the *Hawke* slowed (I estimate this from the disappearance of her bow wave), and fell in behind the *Olympic*. The situation at this time is

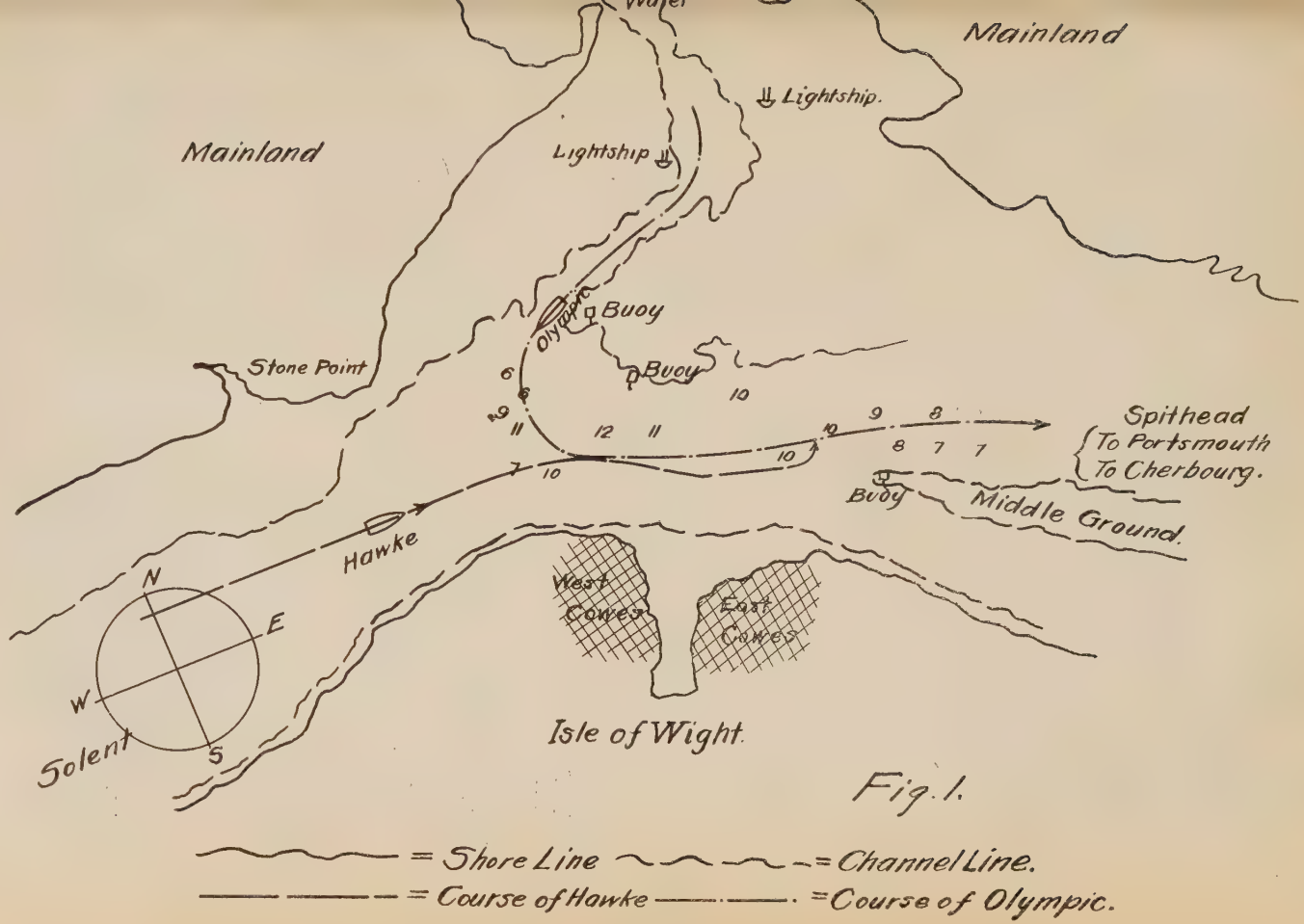
Mainland
Lightship.
Mainland
Lightship
Olympic
Buoy
Buoy
Stone Point
6
9
11
12
11
10
10
9
8
8
7
7
10
10
Spithead
To Portsmouth
To Cherbourg.
Buoy
Middle Ground.
Hawke
N
E
W
S
Solent
West Cowes
East Cowes
Isle of Wight.
Fig. 1.
= Shore Line
= Channel Line.
= Course of Hawke
= Course of Olympic.

FIG. 1.

roughly indicated in Fig. 2. Believing that the danger of collision was gone, I passed on around the bow to the port side of the *Olympic.*

Perhaps three to five minutes later I crossed again to the starboard side and was surprised to find the *Hawke* in the position indicated in Fig. 3. The *Olympic* had completed her turn and had straightened on her new course. The *Hawke* was coming up fast, on a parallel course, perhaps 100 to 200 yards from the *Olympic,* and just beginning to "lap" her. It was nearly the instant when Mr. Reeve mentions that a shear "out" can be expected on the passing ship, and when a few seconds later I saw

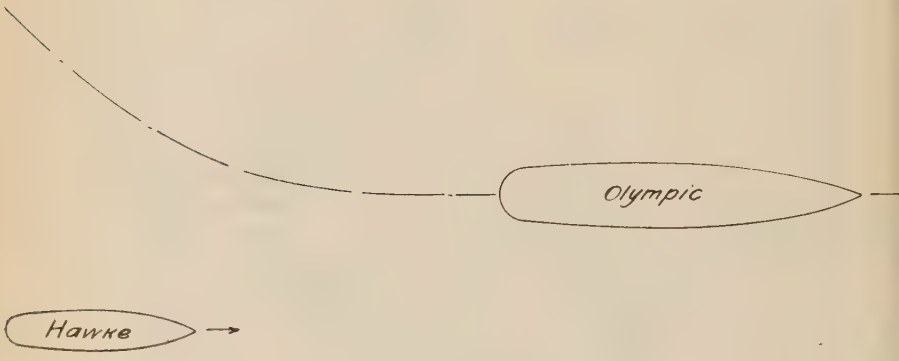

Fig. 2.

what I thought was this "shear out," I remarked to a person to whom I was talking "we will be hit in a minute." A few seconds afterward the *Hawke* swung almost instantly, pivoting apparently on her center, and seemed to leap out of the water toward the *Olympic.* She struck the *Olympic* almost exactly at right angles, at a point about 75 feet forward of the *Olympic's* stern. These later situations are indicated in Figs. 3 and 4.

Two points are to be noted here:

(a) The *Hawke seemed* to very appreciably *increase* her speed in the last few seconds before the actual impact.

(b) Although I know nothing of the *Hawke's* turning circle, she got around to an eight point change of course in an incredibly short time, and I do not think she could have made as sharp a turn had she been using her engines.

In such a collision it is instinctive to look for white churned water at the ramming vessel's stern, but I am positive that the *Hawke's* engines were either not going astern at the instant of collision, or else they were barely started astern. This may be accepted as a proof of the quickness of the turn from the parallel course; in other

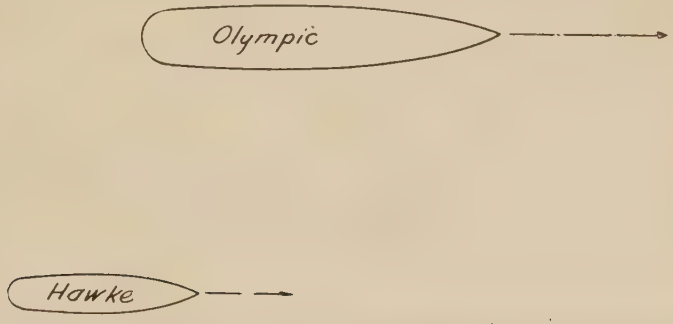

FIG. 3.—*Hawke* beginning to lap *Olympic*. Water shoaling rapidly due to influence of middle ground, see Fig. 1.

words, the time from what seemed safety to actual impact was too short to permit of the reversing of the *Hawke's* engines.

On board the *Olympic* nothing was done either with helm or engines. There would have been no time to do anything had the

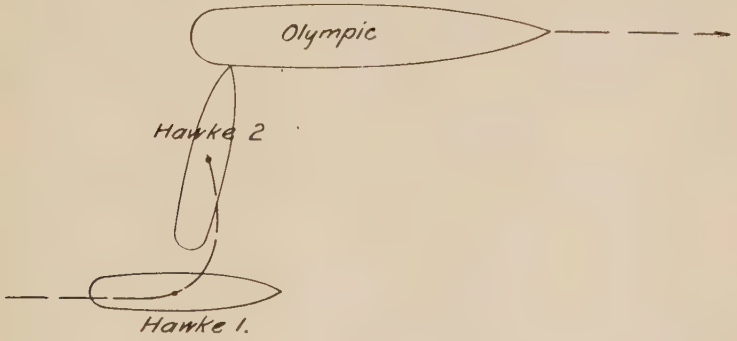

FIG. 4.

attempt been made. However, I doubt greatly that anyone on the *Olympic's* bridge had the slighest warning of the collision until the instant of actual impact. View aft from the *Olympic's* bridge is not good, and her officers must have been busy with her navigation down the channel. Further they would have had no rea-

son, *without a clear understanding of the principles of interaction between ships,* to pay any attention to the *Hawke,* she being in all respects "an overtaking ship" under the rules of the road.

I am unable to state whether the *Hawke* made any passing signals before attempting to overtake the *Olympic,* but as no answer was made by the *Olympic,* I assume that she did not.

So far as I could learn, the channel depth was from seven to eight fathoms, and the *Olympic* was drawing from 37 to 38 feet.

To recapitulate:

(a) At the situation shown in Fig. 1, the *Hawke* clearly has the right-of-way over the *Olympic.*

(b) However, the *Hawke* slowed, allowing the *Olympic* to turn into the channel ahead of her, and thus temporarily cleared the situation by following into a safe position astern, or rather, astern and to starboard of the *Olympic.*

(c) That the Hawke only again put herself in a dangerous position by later increasing her speed in an attempt to pass the *Olympic.*

(d) That after a certain point the situation then became an ideal case of what Mr. Reeve so clearly explains, and that from that point on results were in entire accord with theory.

Since the collision between the *Hawke* and the *Olympic* was so typical of a situation which may now frequently arise, but which, because it has been so rare in the past, is not generally understood, I consider it most advisable to place before the service at large, without further delay, an explanation of the interaction between passing vessels.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

FLAG OFFICERS IN THE UNITED STATES NAVY.

By Rear-Admiral A. C. Dillingham, U. S. Navy.

In looking over the Navy Register (1911) it will be found that with the rear-admirals now (Sept. 13, 1911) on the active list, together with those captains who will become rear-admirals by September, 1917, there will be 51 rear-admirals available for flag duty in that period.

The following list, with dates of commissions as rear-admirals, and the length of time each will have to serve before retirement for age, is submitted as interesting in showing how far we have really progressed, with the present system of promotion, in getting flag officers who shall have time enough to serve as such before retirement, to guarantee a progressive policy in fleet.

No.	Date of commission.	Date of retirement.	Time available for flag duty before retirement.
1	4 July, 1908	30 Dec., 1911	3 mos.
2	11 July, 1908	17 Dec., 1911	3 mos.
3	30 Oct., 1908	10 May, 1912	8 mos.
4	30 Nov., 1909	13 Feb., 1913	1 yr. 5 mos.
5	4 Dec., 1909	15 June, 1913	1 yr. 9 mos.
6	27 Dec., 1909	10 May, 1914	2 yrs. 8 mos.
7	9 Jan., 1910	10 Oct., 1913	2 yrs. 1 mo.
8	20 Feb., 1910	7 June, 1912	9 mos.
9	11 Mar., 1910	27 Apr., 1912	7 mos
10	17 Mar., 1910	7 Oct., 1911	1 mos.
11	17 Nov., 1910	31 Mar., 1914	2 yrs. 6 mos.
12	4 May, 1910	10 July, 1914	2 yrs. 10 mos.
13	20 Oct., 1910	20 Mar., 1913	1 yr. 6 mos.
14	7 Nov., 1910	13 Feb., 1914	2 yrs. 5 mos.
15	14 Nov., 1910	10 Aug., 1916	4 yrs. 11 mos.
16	1 Jan., 1911	11 July, 1915	3 yrs. 10 mos.
17	29 Jan., 1911	16 Dec., 1916	5 yrs. 3 mos.
18	8 May, 1911	6 Aug., 1915	3 yrs. 11 mos.
19	19 May, 1911	15 Dec., 1914	3 yrs. 3 mos.

No.	Date of commission.	Date of retirement.	Time available for flag duty before retirement.
20	14 June, 1911	29 July, 1915	3 yrs. 10 mos.
21	13 July, 1911	7 Sept., 1915	4 yrs.
22	14 Sept., 1911	13 June, 1916	4 yrs. 9 mos.
23	17 Oct., 1911	19 June, 1915	3 yrs. 8 mos.
24	17 Oct., 1911	29 July, 1916	4 yrs. 9 mos.
25	27 Apr., 1912	7 Apr., 1917	5 yrs.
26	7 June, 1912	23 Nov., 1917	5 yrs. 5 mos.
27	13 Feb., 1913	26 Nov., 1915	1 yr. 9 mos.
28	26 Mar., 1913	5 May, 1915	2 yrs. 2 mos.
29	15 June, 1913	30 June, 1917	4 yrs.
30	13 Feb., 1914	1 Nov., 1917	2 yrs. 9 mos.
31	10 Mar., 1914	13 Aug., 1916	2 yrs. 5 mos.
32	10 July, 1914	8 Dec., 1918	4 yrs. 5 mos.
33	15 Dec., 1914	11 May, 1918	3 yrs. 5 mos.
34	15 Dec., 1914	12 Apr., 1918	3 yrs. 4 mos.
35	5 May, 1915	26 Oct., 1918	3 yrs. 5 mos.
36	19 June, 1915	30 July, 1917	2 yrs. 1 mo.
37	11 July, 1915	4 Apr., 1918	2 yrs. 9 mos.
38	29 July, 1915	5 July, 1916	11 mos.
39	6 Aug., 1915	28 Nov., 1916	1 yr. 3 mos.
40	7 Sept., 1915	20 Oct., 1917	2 yrs. 1 mo.
41	26 Nov., 1915	5 Oct., 1918	2 yrs. 11 mos.
42	13 June, 1916	7 Sept., 1919	3 yrs. 3 mos.
43	5 Feb., 1916	1 Sept., 1919	3 yrs. 2 mos.
44	10 Aug., 1916	1 Jan., 1920	3 yrs. 5 mos.
45	13 Aug., 1916	25 Sept., 1917	1 yr. 1 mo.
46	28 Nov., 1916	Apr., 1920	4 yrs.
47	16 Dec., 1916	14 Apr., 1918	1 yr. 4 mos.
48	17 Dec., 1916	25 Sept., 1917	9 mos.
49	7 Apr., 1917	18 Aug., 1920	3 yrs. 4 mos.
50	30 June, 1917	11 Aug., 1921	5 yrs. 2 mos.
51	30 July, 1917	11 Feb., 1919	1 yr. 7 mos.

It will be observed that most of the officers on this list who have any considerable time to serve as rear-admirals are now rear-admirals, or will be very soon commissioned as such, and for at least six years we are going to be without a sufficient number of flag officers, who will have enough time to serve as such before retirement for age, to meet the requirements of a progressive policy in the fleet.

I believe it to be a recognized deplorable fact that we are obliged to change the commander-in-chief too frequently, and this fact is the cause of our not getting beyond the preliminary stage in

battle tactics and preparedness for battle. A new commander-in-chief, with a new staff, does not begin where his predecessor left off, and this is a natural result of a lack of experience of our flag officers as such; the same may be said of the new staff. The new commander-in-chief may not have the confidence in the methods of his predecessor to proceed with them, and it is more than frequently the case that the new commander-in-chief feels in a way bound to make changes. I have seen this with two most excellent and conscientious commandants; the first pointed out all the good things that he had done, while shortly after, his relief, the new commandant, in showing me around his command said: "Why my predecessor did" such and such a thing "I do not know. I intend to pull it down and do" so and so.

A new commander-in-chief may not have the confidence in himself, when first taking command, to progress at once from where his predecessor left off, and nothing is more discouraging to the personnel of the fleet than to find retrograde from, or a cessation of, progress that had been going on. A commander-in-chief must exert his personality, and to such an extent as to have the entire confidence of the fleet in his ability.

What we need, it seems to me, is an organization that will allow a progressive fleet policy to be adhered to, whether the commander-in-chief has one or six years to serve before retirement, or whether he has had previous experience as commander-in-chief or not. How shall we accomplish this? In answering this question, I suggest the creation of a permanent general staff afloat, the commander-in-chief with this staff to be *out* of formation in time of peace, with a junior flag officer in command of *each* division of the fleet. A permanent general staff afloat presided over by the commander-in-chief, for the administration and conduct of the fleet.

The whole business of this staff, in general, should be to prepare the fleet to capture or destroy the vessels of an enemy which it is its duty to encounter, and, in particular, to prepare to capture or destroy the vessels of the most probable enemy of this era.

This staff should prepare and submit to the commander-in-chief all matters of training, drills, exercises and battle practice, and be prepared to lay before a new commander-in-chief the exact status of preparedness of the fleet for battle, with the view of having the policy of the fleet continue its purpose without interruption.

This staff should not change with the change of commander-in-chief but be as permanent as is possible, its members being detailed for an indefinite period—not less than two years—longer if possible.

This permanent general staff afloat should be composed of officers selected by the Secretary of the Navy as follows:

Chief of staff, with rank not below captain.
Engineer officer, with rank not below commander.
Gunnery officer, with rank not below commander.
Torpedo officer, with rank not below lieut.-commander.
Paymaster, with rank not below pay inspector.
Medical officer, with rank not below medical inspector.
Marine officer, with rank not below major.
Secretary, with rank not below lieutenant.

The commander-in-chief may select his personal staff, consisting of flag lieutenant, two aides and a secretary.

The staff of the commander-in-chief at present is of about the same composition as the staff suggested, but there is this important and vital difference between the two: the present staff changes with the commander-in-chief, whereas the staff suggested is to be permanent.

This permanent general staff afloat, coupled with a proper system of training flag officers, will insure, as far as is possible, a progressive fleet policy, and supply the fleet with flag officers who can meet the requirements of a battle fleet.

This method, or organization, should in no way interfere with the prerogatives of the commander-in-chief; he is always supreme. He presides over the staff, which is advisory, and its permanency should continue a policy in force.

In considering the above list it would seem that, for the purposes of the fleet, those officers with the longest time on the active list would be the coming men in fleet, but because an officer is a young man of his class is no guarantee that he is best for flag duty. These officers with the rest should be tried out; they should have the opportunity of showing whether or not they are fit. The selection of the commander-in-chief should be made for tried efficiency alone. It is possible that a good captain will make a good flag officer, but it does not follow. It is well known that certain officers develop a faculty for tactical work, that is very

strong and practical. The work at the War College has developed this fact, and there is no place better for such development than the War College, except it be in fleet. This is the function of the War College. The prime object of the War College is to prepare the flag officer for the very great responsibility he is obliged to assume in fleet, or better, it is the place where the flag officer may prepare himself for the serious business of war by taking advantage of the facilities offered by that institution, and for this reason it would be best if captains eligible for flag duty in the near future could attend the War College before going into fleet.

We seem to neglect the military side of our profession by ignoring the facilities offered by the War College. We are serving in a military profession in a non-military country, and such a condition demands, on the part of our officers, greater efforts to preserve the military character than would be necessary in a military country.

Foreign naval powers are paying great attention to the training of junior flag officers, with a view to being able to select the best to conduct the fleet in battle. These countries make a more serious matter of the great responsibilities which must rest upon the commander-in-chief in time of war than we appear to do, and it behooves us to take advantage of all our facilities for preparation, that we may be able to compete successfully in battle. No country has an institution offering such advantages for the study of war as our War College and it would seem very unwise on our part if we neglect or ignore these advantages. The theories and axioms of battle are gotten from naval history and the game board, but for the practical application of these theories and axioms in conducting his force against the force of an enemy, the flag officer must have practice afloat, and he needs every possible opportunity for such practice. The flag officer must have his training; it is the most important, most essential of all training, for what good results can we get from all other efforts for efficiency, if the leader fails?

To this end the junior flag officer should be detailed in fleet for one year, and during that time he should be given every opportunity to develop his aptitude for fleet command, by having as far as is possible, absolute responsibility for the preparedness of his division for battle, and by being pitted against an opposing force in battle drills under battle conditions.

Rear-admirals and captains who will become rear-admirals in the near future should be employed *only,* in fleet, at the War College, on the general board, chief of the permanent general staff afloat or as aids to the Secretary of the Navy; no such officer should be employed on shore, or any duty (excepting as president or members of general courts), which has not to do with the preparedness of the fleet for battle. The junior flag officers should have had duty at the War College before going to fleet; they should return to the War College or to duty on the general board, unless the Secretary of the Navy should require their services as aids.

All other shore duty, such as navy yards, boards, permanent courts, bureau, training stations, receiving ships, etc., should be performed by those officers who by reason of their early retirement for age will be of little or no use in fleet.

In submitting this article to the Institute, I invite discussion.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LATEST DEVELOPMENT IN CONDENSING SYSTEMS.*

By LIEUTENANT (J. G.) J. B. HOWELL, U. S. Navy.
Student Officer, School Marine Engineering.

If a condenser contained steam and no air, the vacuum would be governed by the mean temperature of the steam throughout the condenser, and an air pump would not be required. In practice, air exists in all steam condensers; its presence has the effect of retarding the condensation of the steam on the tube surface, and it has to be removed in a state of saturation with water vapor by an air pump.

When a condenser is at work and a stable condition has been established, the weight of air entering the condenser and leaving it in a given time is the same; but the ratio of air to steam in a reasonably air-tight system is so small that its effect is negligible. As the fluid passes through the condenser and is condensed, the ratio of air to steam increases rapidly, until at the air-pump suction the air forms a very considerable proportion of the mixture.

There is, as is well known, a definite relation between the temperature and the pressure of saturated steam at a given pressure; but there is also a definite and lower temperature corresponding to every proportion of air to steam in saturated air at every pressure; and for a given vacuum the fall in temperature of the gaseous mixture, which passes through a condenser and on to the air pump, changes with the ratio of air to steam in a perfectly definite manner.

As the steam passes through the condenser and becomes richer in air, the rate of transfer of heat from the steam to the circulating water is greatly reduced. Even with an air-pump capacity in proportion to the amount of air gaining access to a condenser,

* The information contained in this article was obtained from Professor R. L. Weighton, Mr. D. B. Morison and Mr. William Wier.

the efficiency of the condensing surface must be adversely affected by increased quantities of air passing through, because the opportunities for contact of the steam with the tube surface is greatly reduced. If the air-pump capacity is not increased in proportion to an increase in air leakage, the lower rows of tubes automatically become ineffective for condensing purposes, and this so reduces the effective surface that a decrease in the vacuum is required, and ensues in order to re-establish the necessary equilibrium.

The weight of air entering the condenser depends upon (1) the air leakage in the system at all parts subjected to a pressure below atmospheric, and (2) the proportion of air contained by the feed water when entering the boiler.

Fresh water carried in feed tanks for make-up contains at atmospheric pressure from 2 to 3½ volumes of air per 100 volumes of water. If this water is introduced into the condenser about 70 to 90 per cent of this air is driven off.

Broadly it may be said that in no type of condenser can the condensing capacity due to its dimensions be maintained, unless the air pump is sufficient to render all the tube surface available for condensing the steam; the air pump must in fact dominate the condenser under all conditions of normal air leakage.

All condensers should embody the following feature of design: maintenance of uniform flow at right angles, both to the axes of the tubes and to the falling streams of condensed steam water, the depth of the fall being determined by the area necessary for the flow of steam between the rows of tubes, and this depth is small relative to the length of flow from the steam inlet to the air outlet.

The scientific consideration of the problem of condensers has led the engineers of the present day to recognize the futility of using the old type of condenser, and the design of the "centraflo" type has resulted therefrom.

It is universally admitted that the flow of gases in the condenser must be unrestricted and that, above all things, the pressure at the bottom of the condenser must not be greater than the pressure at the top. The density of the vapor in the condenser is, of course, greater at the bottom than at the top, and assumes the form of layers of different densities.

With the old design of condensers these layers were spread out horizontally over a large area and consequently the thickness of

the various layers was not great. The air and water pumps would start their suction on the bottom layer, *i. e.,* the most dense one, and on the first part of the stroke the condensate would enter the pump; but this heavy layer would soon be pierced before complete removal and a less dense layer drawn into the pump. This, of course, reduced the removal capacity of the pump and consequently the efficiency was poor. By the simple means of making the bottom of the condenser adjacent to the suction into a V-shape, the layers were piled up vertically instead of being spread out horizontally and the pump took its suction from a uniform layer throughout the stroke.

Experiments were then carried on with regard to the flow of vapor using a condenser without baffles and comparing the results with same condenser fitted with baffles, the baffles were mounted on rods and could be put into action or taken out without stopping the operation of condensing.

As soon as they were brought into action the vacuum increased several inches without altering any other conditions of condensing plant. From this it was ascertained that the steam vapor followed the lines of least resistance, which were in this case the sides of the condenser, and that baffles were absolutely necessary to insure that the vapor would pass around the tubes.

The velocity of the steam being greatest upon entering the condenser and of comparatively small density, the tubes were spaced far apart at the top of the condenser and closer together as they approached the bottom to allow for the increase in density of the vapor.

From the consideration of these experiments the so-called "contraflo" condenser was designed and the results obtained were eminently satisfactory.

The next problem that confronted the engineer was to provide a satisfactory installation of pumps which would remove the vapor of condensation and at the same time reduce the weight of air in the condenser. The dual air-pump system met the requirement under normal conditions, but it was found that in cases where the air leak in the system was above the normal the efficiency of this system was small.

The "kinetic" and "bi-therm" systems were then designed to meet these abnormal conditions and are discussed later on.

From the results of the experimental work of these laboratories the following conditions are drawn:

(1) It is conducive to efficiency in a surface condenser that the water resulting from the condensation should be intercepted and removed from the condenser as soon as possible after it has been formed.

(2) The capacity should be a minimum consistent with the accommodation and with the necessary surface, and the design should be such as to receive a uniform flow of vapor throughout the condenser section.

(3) The condensing water should travel at a fairly high speed through the tubes, and it should enter at the bottom and leave at the top.

(4) With suitable condenser arrangements and a reasonably air-tight system, there is nothing gained in efficiency by the use of air pumps exceeding in capacity 0.7 of a cubic foot per pound of steam condensed up to a limit of close upon 29″ vacuum.

(5) With proper design of condenser, the temperature of the condensing water at discharge point may be equal to or slightly higher than the temperature due to the vacuum. This holds true for vacuum up to 29″.

(6) With suitable condensing design, the temperature of the hot well may be from 3° to 5° higher than the temperature due to the vacuum. This holds up to 29″.

(7) With suitable design of condenser, and in conjunction with "dry" air pump, a condensation rate of at least 20 pounds of steam per square foot of surface per hour will be maintained in association with a vacuum 28½″; and a quantity of condensing water equal to 24 times the feed water at an inlet temperature of 50° F.

There are three systems in present use to meet these requirements; the first is commonly known as the "dual air-pump" system. It is shown in Plate I and is self-explanatory. The second is the "kinetic" system and the third the "bi-therm" system, which is a compromise between the first and second.

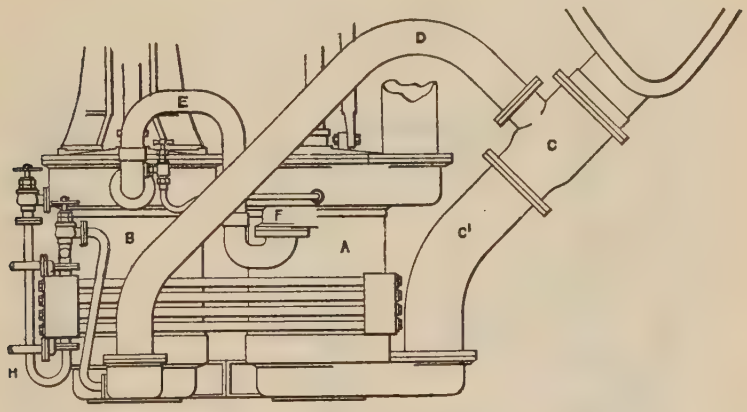
DUAL AIR-PUMP SYSTEM.

(Developed by G. and J. Wier Co.)

The dual air-pump system consists of a wet-air pump working at a temperature due to the vacuum in combination with a dry-air

pump working at a much lower temperature, on account of which it is enabled to handle air leakage without serious cooling of the main body of feed water.

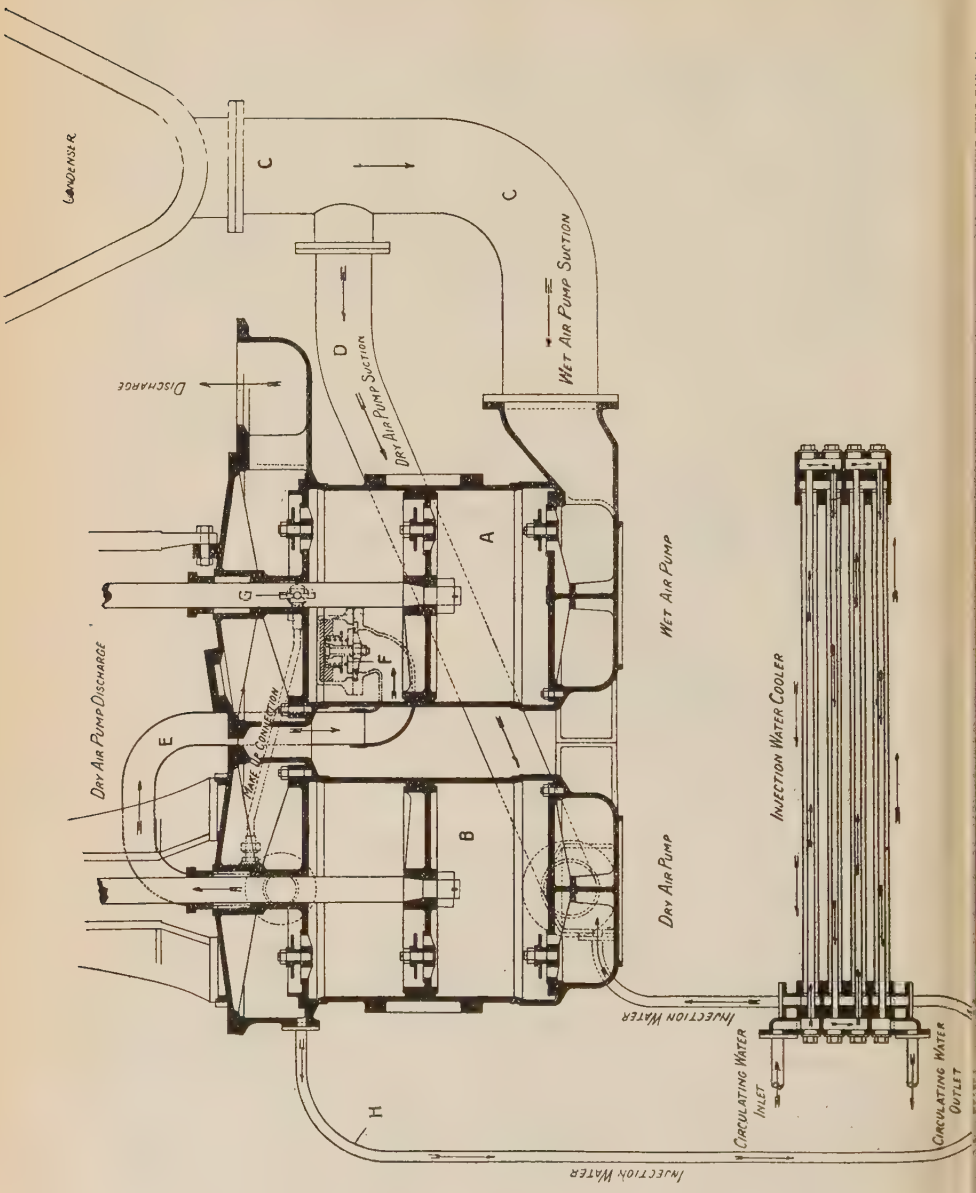
Referring to the diagram of the dual air-pump system, the wet-air pump *A* is situated below the steam cylinder, as this pump is the only one which works under considerable load; the dry-air pump *B* is driven by the beam links in the usual manner. One connection, *C*, is made to the condenser, but a branch pipe, *D*, is led to the dry-air pump, the connection being made in such a manner that the water from the condenser will pass by *C'* to the wet pump. Both the pumps are generally of the three-valve marine



WEIR PATENT "DUAL" AIR PUMP, COOLER AND CONNECTIONS.

type, but in certain cases the dry pump may be of the suction valveless type.

The dry-air pump discharges through the return pipe *E*, through a spring-loaded valve, *F*, into the wet pump at a point below its head valves. When starting the pump the filling-valve *G* is opened for a minute or so to enable the vacuum to draw in a water supply for priming from the hot-well pump. The valve is then closed and the water passes from the hot well of the dry pump by the pipe *H* to the annular cooler, through which a supply of cold sea water circulates, and after being cooled passes into the suction of the dry pump; then passing through the pump it becomes heated and again passes to the cooler, and so on in a continuous circuit, any excess passing over the pipe *E* to the wet pump. The


CONDENSER
C
C
D
DISCHARGE
DRY AIR PUMP SUCTION
WET AIR PUMP SUCTION
A
G
F
E
DRY AIR PUMP DISCHARGE
MAKE UP CONNECTION
B
WET AIR PUMP
DRY AIR PUMP
INJECTION WATER COOLER
INJECTION WATER
CIRCULATING WATER INLET
CIRCULATING WATER OUTLET
H
INJECTION WATER

spring-loaded valve F is adjusted to maintain a vacuum of about 20″ in the dry-pump hot well when the condenser is working at 28″ vacuum, and this difference of 8″ in vacuum is sufficient to overcome the friction in the cooler and pass the water into the suction.

The Kinetic Rotary Air-Pump System.

(Developed by Mr. D. B. Morison.)

In the kinetic system the air and non-condensible gases are removed from the condenser by the action of a steam jet followed by a special system of water jets known as the "kinetic ejector."

Jets of water moving at a high velocity through suitably shaped orifices have been used for many years for the purpose of producing partial vacuum for various purposes, including the rarefication of the vapor space of condensers.

A water jet has of itself a relatively low capacity for assimilating and withdrawing air, and, therefore, should this type of air extractor be employed when the quantity of air to be removed is appreciable, then the quantity of water or the pressure necessary for the jet is large and the expenditure of power excessive.

The air-withdrawing capacity of any water jet device is, however, greatly increased if the air to be extracted is previously mixed with steam.

In case of the kinetic plant, steam is introduced into the air-suction pipe through a high-velocity nozzle, thus entraining the air and intimately mixing with it. This steam is condensed on the secondary sprays of the kinetic ejectors, and the resulting liquid carries with it all occluded air and gases which are ejected to the atmosphere by the main water jet.

The steam jet is fed with live steam in the case of plants fitted with electrically-driven pumps, or with exhaust steam at a pressure of about 20 pounds above atmosphere, if this be available. The quantity of steam required varies according to the air leakage and size of plant, but from one-half to three-fourths of 1 per cent of the steam to be condensed may be taken as the average figure for installations of considerable dimensions.

The water for the kinetic jet is water of condensation which has already been removed from the condenser, and the whole of the latent heat contained in the steam used in the steam nozzle is absorbed by this water, which is subsequently discharged to the

feed tanks at a correspondingly higher temperature than when it left the condenser.

The water of condensation is withdrawn from the condenser and discharged against pressure of the atmosphere by the action of two pumps on the centrifugal type, known as the " head " and " pressure " pump, respectively. The " head " pump works under the pressure of the condenser both on the suction and the delivery sides, and is designed so that it will handle the required quantity of water with an extremely low head on the suction side of the pump. The water is discharged from this pump into a stand-pipe or receiver which provides a natural head of water on the inlet side of the " pressure " pump by which the water is finally ejected against atmospheric pressure. This arrangement makes it possible to place the pumps only a few inches below the level of the condenser bottom, and a perfectly regular discharge is maintained at all loads, the amount corresponding to the quantity of steam condensed.

The energy lost from the system in a normally-designed installation does not exceed 0.0003 of the energy developed by the total steam which is condensed.

The whole energy of the steam jet used to extract the air and drive the water-extraction pump is returned to the system, with the exception of

(a) The theoretical energy required for the extraction of water, and

(b) The theoretical energy required for the compression of the air against the atmospheric pressure.

The energy expended, but again recovered, takes the following form:

(a) Sensible heat in the steam jet.

(b) Latent heat in the steam jet.

(c) A portion of the mechanical losses in the mechanism.

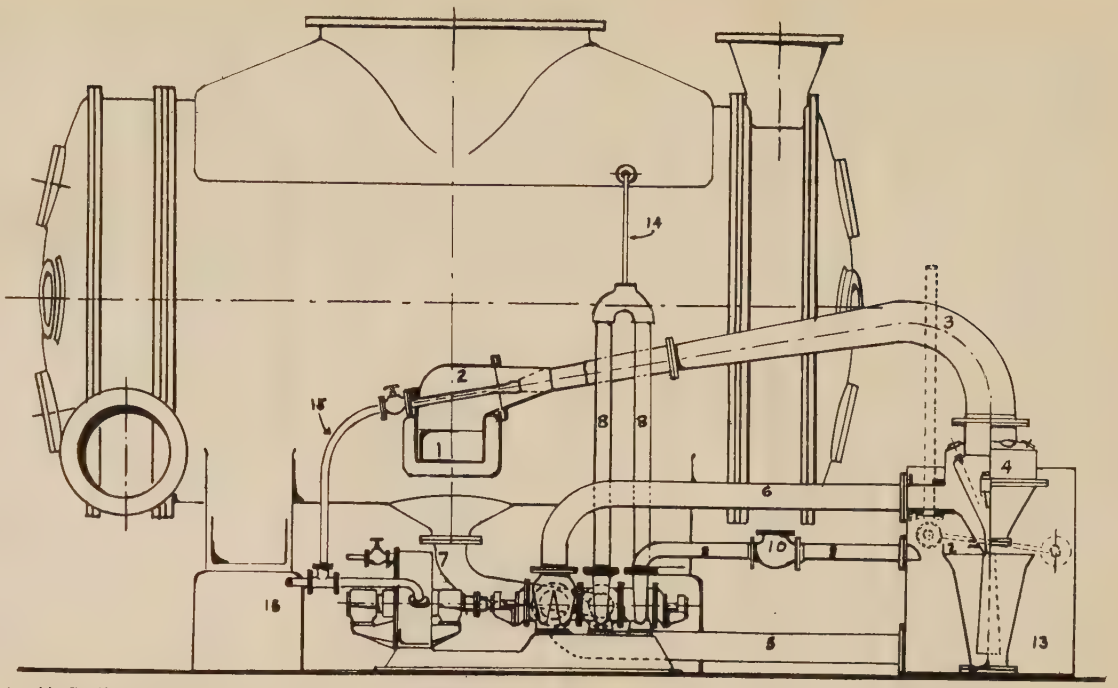
(d) A portion of the fluid frictional losses in the pumps.

(e) A portion of the energy used to produce the high-velocity air-extracting water jets.

Explanation of the Diagram.

Rarefication of the condenser is effected by steam jet (2), followed by the action of the kinetic ejector (4), supplied with water by the kinetic pump through pipe (5) and discharging into the kinetic tank (13).

DIAGRAMMATIC ILLUSTRATION OF CONDENSER WITH KINETIC AIR PUMPS.



1.—Air Suction Orifice on Condenser.
2.—Exhaust Steam Jet.
3.—Air Pipe to Kinetic Ejector.
4.—Kinetic Ejector.
5.—Suction Pipe to Kinetic Pump.
6.—Kinetic Pump Discharge Pipe.
7.—Condensed Water Pipe to Head Pump.
8.—Stand Pipe between Head and Pressure Pumps.
9.—Pressure Pump Discharge to Tank.
10.—Non-return Valve.
11.—Feed Water Delivery Pipe.
12.—Float Controlled Feed Delivery Valve.
13.—Kinetic Tank.
14.—Pressure Equalizing Pipe.
15.—Exhaust Steam to Jet.
16.—Surplus Exhaust Steam.

Water of condensation flows through pipe (7) into the head pump; thence through stand-pipe (8) to the pressure pump; and thence through pipe (9) and non-return valve (10) into kinetic tank. The excess water in the tank corresponding to the feed water is delivered by the kinetic pump through pipe (11) and float-controlled valve (12) into feed tank, which may be placed overhead.

The installation of this system occupies the same space and requires the same power, but only 52 per cent of the weight required in present air-pump systems.

Typical installation shown in diagramatic sketch.

The following data of tests, actually made by myself at the works of Richardson & Westgarth, are submitted to give an idea of the kinetic system.

PLANT.

Driving turbine for both pumps. 10 H. P.: 1900 r. p. m. to 2300 r. p. m.

Capacity of pumps normal. 10,000 pounds of water per hour.

Maximum capacity of installation. 1500 K. W. set. 30,000 lbs. water per hour.

Capacity of pump (1): 9000 gals. per hour, normal.

Capacity of pump (2): 12,000 to 14,000 gals. per hour, normal.

Temperature of feed tanks 90° F., constant.

Temperature of circulating water 60° F., constant.

The following tests were made:

Introduction of air leak in pipe, 1 mm., 2 mm. and 3 mm. holes, successively.

Under these conditions the results were as follows:

Size of Air Leak.	Vacuum in Condenser.	Vacuum in Jet.	Jet Pressure in pounds.
1 mm.	29.82″	26.00″	15 lbs.
2 mm.	29.6″	26.5″	40 lbs.
3 mm.	29.3″	26.00″	80 lbs.

BI-THERM AIR-PUMP SYSTEM.

(Developed by Mr. D. B. Morison.)

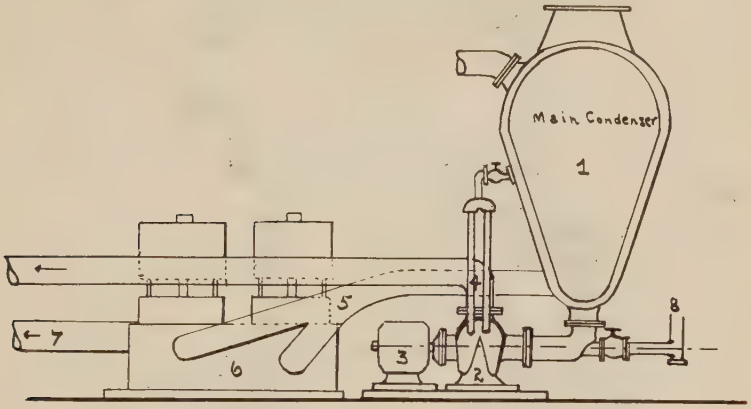
The bi-therm installation is a compromise between the present "dual" system and "kinetic" system and may be installed in connection with present designs.

The present form of air pump is used with the addition of a small centrifugal pump, steam or electrically driven.

The channels from the condenser are so arranged that the centrifugal pump removes the condensed water under normal conditions and the air pumps remove the air from the condenser. If the condensed water increases above normal the excess will go to one of the barrels of the double air pump, and if a further increase occurs then both air pumps and centrifugal pump will handle the condensate.

This combination not only increases the efficiency of the condensing plant, but at the same time affords three separate means of

DIAGRAMMATIC ILLUSTRATION OF CONDENSER WITH BI-THERM PUMPS.



1.—Main Condenser.
2.—Centrifugal Pump.
3.—Motor or Small Turbine.
4.—Discharge to Feed Tank.
5.—Suction to Air Pumps.
6.—Air Pumps.
7.—Discharge from Air Pumps.
8.—To Aux. Exhaust.

taking care of the vacuum in case of accident to any of the parts, namely:

(a) Combination of two air pumps and the centrifugal pump.
(b) One air pump and centrifugal pump.
(c) Both air pumps alone.

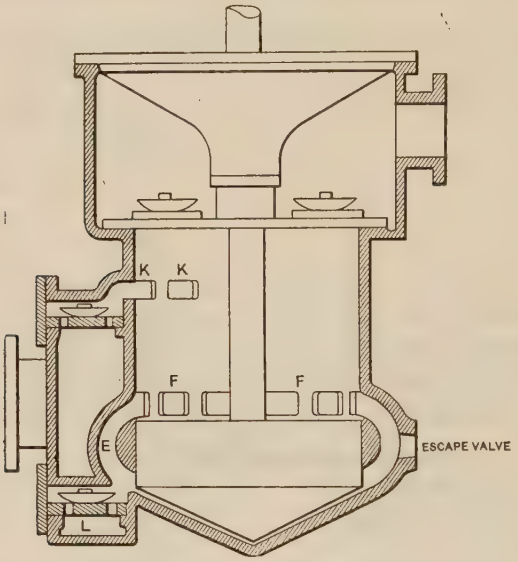
In addition to these advantages the reciprocating air pump will work under a steady normal load and the excessive wear on these pumps will be materially reduced.

DESCRIPTION OF THE BI-THERM PUMP.

Under normal conditions the centrifugal pump removes all the water of condensation, and the air pump works in a practically constant vacuum, which ensures steady action and less wear on the reciprocating parts.

An excellent form of air pump has been designed for use in connection with this installation and is essentially as follows:

On the down-stroke of the valveless bucket there is a diminution of pressure in the barrel above the bucket until the latter passes the air inlet ports *KK*, through which air is drawn into the barrel from the condenser, and continues to flow into it until the ports *FF* are uncovered. Meanwhile, the air and water which have been drawn from the condenser through the foot valves *L*



NEW AIR-PUMP DESIGN.

into the lower end of the pump during the previous up-stroke are, as soon as the bucket uncovers the ports *FF*, forced through the valveless passage *E* without shock and with minimum resistance and thereafter through the ports *FF* into the barrel above the bucket. Consequently, the bucket rises with a double charge, the design enabling a double-acting vacuum-producing effect to be efficiently obtained.

An escape valve is necessary when starting up the pump, unless it is previously drained, and in practice this valve discharges either back into the condenser or into the hot well above the head valves, both places being successful in practical use.

DISCUSSION.

Absence Over Leave in the Fleet.

Captain John G. Quinby, U. S. Navy.—The undersigned has read over with great interest the paper of Captain Fullam on the subject "Absence Over Leave in the Fleet," and during his seven years in the command grade has made a careful study of the subject discussed. He thoroughly agrees with the essayist in the statement that naval officers are to blame for not punishing with sufficient severity this offense. The lack of uniformity in the punishment for this offense awarded by different commanding officers is one strong reason for the continuance and prevalence of the offense. Men readily see and put their own interpretation on the lack of system shown in meeting this trouble. He also agrees with the essayist in his statement that if men are given to understand they must meet this condition fairly and squarely they will rise to the occasion and meet it.

In the earlier days of the careers of all the commanding officers now on the active list of the navy, the present standing for petty officers and others of inferior rating could never have been met. It was only after a petty officer was made a petty officer and given to understand his responsibility that the supply was met. Formerly the most inveterate drunkard in the ship, and probably the most prone to break his liberty, and who had the least sense of military discipline, was made a petty officer, only depending upon his dependability under the eyes of a commissioned or warrant officer, and his seamanlike qualities.

When the proposition was put to the seamen that American born men of good moral standing, correct habits, and a finer sense of military discipline were the *desiderata* for fulfilling the requirements of a petty officer, they rose to the occasion at once, with the result that now our chief petty officers particularly are men whose equals it would be hard to find in any walk of life.

The undersigned is fully justified in stating that we need have no fear of producing the necessary spirit in the enlisted personnel to effect such a condition of affairs that absence over leave will be a rarity, rather than, without a doubt, the most common offense every commanding officer in the navy faces.

As is usual in all reformations of a general far-reaching character, legislation is required to make "The punishment fit the crime." It is suggested that the following would be necessary:

To so extend the authority of Summary Courts-Martial that they could with the approval of the convening authority, sentence a habitual liberty breaker to three (3) months imprisonment at hard labor in a disciplinary camp, similar to that recently established at Port Royal, S. C., the confinement to take effect at once without reference to Washington after having been approved by the senior officer present; the man's pay to be stopped.

except the customary three dollars ($3.00) per month for necessary prison expenses; and the three (3) months to be automatically added to his term of enlistment.

By habitual liberty breaking referred to, it is meant such as offend in this manner three (3) times in any one calendar year. This of course would include men that we are sure exist, who break liberty repeatedly in order to get their discharge by a "Bad Conduct Discharge," and who are willing to have their character blackened by such a discharge in order to obtain their release from their voluntary entrance in the service.

Except for the above addition to the remedy suggested by the essayist, the writer has with singular consistency followed almost intuitively the method pursued by him, not, however, with the success he claims.

Many of the petty annoyances, such as delays at mustering in and out liberty parties, are no doubt responsible for much of the prevalence of this offense, and were steps taken by the Navy Department through general orders to avoid the delay in mustering in and out, and making the punishment for the first and second offense uniform throughout the service, save for the difference in the humanity of the several commanding officers who judge each case individually at the mast, the occurrence of these annoyances would become less prevalent, the effect would be instantly felt, and we could wait for the slower channels of Congressional action which would give us the rest of the remedy needed, that is, the necessary increase in the jurisdiction and authority of the Summary Courts-Martial.

The writer, while in command of the U. S. S. *Montana*, even with the authority vested in the commanding officer, met this delay by establishing a Special Fourth conduct class, which automatically gave a man the limit of punishment the commanding officer could inflict (deprivation of liberty for three months). This class was awarded to liberty breakers for the third offense in any one calendar year, and for one other offense, that of failing to take prophylactic treatment. It did not meet the required conditions, for as stated above, the writer does not claim the same success with the method as the essayist claims for the *Mississippi*. Could this have been made to fill the conditions prescribed in the necessary additions to the authority of the Summary Courts-Martial, the writer feels confident an equal or greater degree of success would have obtained. In all of this he supposes that the commanding officer in the daily police court at the mast listens with care and an insight bred from long experience to each case, inquiring into the merits of each offense; weighing the testimony of all witnesses the offender may bring, and then awarding suitable punishment.

CAPTAIN W. R. RUSH, U. S. Navy.—The essayist has written a timely and excellent paper. We must all agree with his findings and conclusions, and must all believe any captain indeed very fortunate who can attentively read this essay without mental groanings of *mea culpa*.

The *Mississippi*, however, stands not alone in the effort to combat the evil influence of no method at all; or of the many arbitrary methods of stopping liberty breaking which now prevail throughout the fleet; this can be demonstrated by referring to the records of the flagship *Connecticut*.

The punishment regulations adopted in the *Mississippi* for liberty breaking might have been copied from the ship's regulations of the *Connecticut*, so alike are they; and comparison with the good results obtained in the *Connecticut* shows them as good, and in some instances better than those obtained in the *Mississippi*. Of course, comparisons are odious, but when instanced for good and not for evil, and in the common cause of fleet efficiency, they may be pardoned.

The complement of the *Connecticut* includes 963 men, a considerably larger complement than other ships of the fleet; and during the past year 583 new men have joined the ship, so the *Connecticut* has not been spared in that particular.

As to the results accomplished: During a stay of three weeks at Weymouth, England, only 11 men overstayed liberty and 7 of these for a few hours only.

At Cherbourg from December 8th to 30th last, only 20 men overstayed liberty, and but 5 of these for more than 24 hours.

During the last visit of *Connecticut* to the navy yard, New York, the average daily absentee report was 6 men—nearly all repeaters.

The question of liberty breaking, and of the efficient checking of it on this ship, has received here more earnest consideration than any other matter affecting discipline, and the results in hand, as in the *Mississippi* have fully justified the means adopted.

In the case of *Connecticut* I would paraphrase the essayist on the last page of his article by saying, "It is proper to state in this connection that it has only been by the constant and unremitting personal attention of the *executive officer* that the plan has been a success."

This last page too is the meatiest page of any essay on fleet discipline that has ever appeared in print.

Il faut cultiver notre jardin.

CAPTAIN SPENCER S. WOOD, U. S. Navy.—I am heartily in accord with the views of Captain Fullam as expressed in his paper on "Absence Over Leave in the Fleet." The idea of uniformity in the matter of punishment is not a new one to me, as I suggested to the department in January, 1909, that a board be appointed to draw up a recognized schedule of punishments for offenses so that all ships may work along the same lines. It was also suggested then that this schedule should be elastic enough to admit of a commanding officer using his judgment. If a regular schedule is decided upon for the service, with highest and lowest limits clearly stated, it could be published in the ship's bulletin board and every one would then know just what is awaiting him for every infringement of the regulations.

It is believed that similarity of punishment for the same offense in different ships would do much to lessen the dissatisfaction which frequently exists in some ships with their officers.

The Department disapproved the suggestion, so the matter was dropped, but I have always believed that an upper and lower limit of punishment for the ordinary list of offenses is most desirable. With a well recognized punishment for absence over leave, which would be practically the same on

all ships (and I do not think the one suggested by Captain Fullam is too severe), it seems likely that much of the liberty breaking could be stopped and the men brought to appreciate the gravity of the bad habit which they are forming by this dereliction of duty.

CAPTAIN H. P. HUSE, U. S. Navy.—I am cordially in sympathy with Captain Fullam in the question of liberty breaking discussed in his paper entitled "Absence Over Leave in the Fleet." Restriction to the ship has never yet operated to bring men back on time. Of late years I have acted on this principle, and it is only fair to say that my action was due to a conversation with Captain Fullam about five years ago.

The general plan followed by him as set forth in the nine enumerated paragraphs on page [7] are, in my opinion, about right. I have generally made the limit for trial by deck or summary court five hours instead of three; but on the other hand, the repetition of an offense within three months doubled or trebled it according as it was a second or a third offense. Thus a man three hours late from liberty having been previously punished once for liberty breaking during the preceding three months would be dealt with as having been six hours overtime. Possibly this period of three months should be increased to one year.

All the work on board required to keep the ship in a sanitary and efficient condition is honorable and it should not be degraded by assignment as punishment. Men soon get to look upon certain necessary and disagreeable work as suitable for "extra duty" only, and it becomes a hardship for men in good standing to be required to do it. For this reason, all extra duty should be done *on the quarterdeck* under arms during the recreation or rest periods except Sunday.

Paying the crew monthly instead of doling out "monthly money" in accordance with conduct classes was a great step. It is surprising that it was not done years before. But our enlisted men are only boys after all, and it is to be expected that they will spend most of their money on the first liberty or two after pay-day. This is objectionable for two distinct reasons: First, the possession of so much money soon after pay-day is a bait to every harpy and rum-seller on the beach and the cause of much sore temptation to the youngster. Captain Fullam does not mention it, but most of the liberty breaking is done just after pay-day. The second reason is that our youngster having spent all his money soon after getting it, is left penniless until next pay-day. It is a feast or a famine. At the beginning of the month, he rides in a taxi; towards the end, he prefers to walk—or to stay on board and feel bored and blue.

I have tried a plan of "weekly money" with success. Once a week, every petty officer receives five dollars of his pay; every other man in the ship receives three dollars. To simplify matters, the exact amount must be taken, or none. As a result, the men generally had cash in their pockets, the temptation to "blow in" a month's pay at once was very much diminished, with a consequent reduction in the list of liberty breakers. Indirect results are that there is less money "lost" on board and, that the liberty is more evenly distributed over the month. I have never had the oppor-

tunity yet to apply this scheme to the large crew of a battleship; but in the *Nevada* and in the *Celtic* it presented no difficulties and the co-operation of the paymasters was most cordial. The additional work involved cannot for one moment be weighed against the great material and moral gain.

I have never given any thought to the annoyance of delay in inspecting and sending off the liberty-party. I thank the writer and shall bear it in mind.

It has been my experience that a man returning from liberty a few minutes late is very often marked "on time." This encourages ideas the very opposite of what we wish to instil. The punishment for returning overtime should consist of two parts: First, a fixed punishment for being late; second, a variable punishment depending on the amount overtime. Thus, if a man is five minutes (or one minute) overtime, he would get three hours' extra duty; if four hours overtime, he would get three hours plus twelve hours, or sixteen hours' extra duty, if for a first offense. This would take four days to work off, during which time he would necessarily have no liberty. Saturday and sometimes Wednesday afternoons being recreation periods, eight hours' extra duty can be worked off on those days. The extra duty finished, there are no further restrictions as to liberty, so the men are always very zealous in putting it through.

Deck courts and courts-martial should always inflict the entire maximum punishment for this offense, leaving it to the revising authority to consider mitigating circumstances.

It should be made very difficult to prove a valid excuse for returning overtime. Late trains, delayed trolleys, blocks on the road, fog on the river constitute a wonderful chapter of accidents at the mast if the captain is thought to be easy. A "first offense" may also be pleaded several times, provided the offenses are not too near together, with bad results as to discipline.

I have tried a method of suspended punishments. It depends for its success upon never letting up—every breach of discipline involves the assignment of its corresponding punishment; but the execution of this punishment, in the case of minor offenses, may be suspended, and if the offender has a clear record for three months thereafter, the report is wiped off his record. To put this system into practice, each man must have a conduct card made out when he is sentenced to his first punishment. On this card a complete record of all offenses and punishments is entered, and it is scanned by the captain when the man's case is being investigated at the mast. Should a suspended sentence be hanging over him, its execution is ordered in addition to the new punishment. Forgiving or overlooking minor offenses encourages them; this plan has exactly the opposite effect and works well.

Captain Fullam is right. The lightness with which liberty breaking is treated in the service is a serious matter. It is one of the several disciplinary questions now to be considered. Others are the lack of smartness and energy with which so many of our young officers perform their duties when in charge of the deck, especially in port; the lack of neatness and the careless appearance of our officers in uniform; the failure on the part of

men to salute officers, etc. The time has come to brace up. Is it possible that our work afloat has been a little too strenuous and our people, more especially the officers from lieutenant-commander down, have been worked a little too hard?

COMMANDER W. W. PHELPS, U. S. Navy.—Captain Fullam's observations on absence over leave in the fleet represent the tried experience of the one officer in the navy, who by constant study of the problem and fearless application of his own matured convictions is probably the best authority on the handling of men we have.

The handling and development of the men is the most neglected element of our navy. And it is inexcusable that it is so neglected, the personnel being the most important element of the navy.

I don't hesitate to say that our discipline is not good. The state of discipline is such that some men largely do as they like, not as they are told. We cannot say that discipline is good until we can say that all men *like* to do as they are *told*. Our imperfect discipline is reflected in many little things observed in the day's work. With an improvement in discipline will come a reduction of liberty breaking. To improve discipline, *organization* is the first step. There should be no detail of a ship's activity that is not made dignified and important by being *regulated*. The ship's regulations should be sane, everyone of them standardized to be applicable as near as may be to all conditions of winter and summer cruising. Then every one of them should be patiently and persistently enforced or else revoked. The same applies with even greater force to the navy regulations and the uniform regulations.

Thus the end will be that, throughout the day, every day, every activity of the men will be regulated by routine, and the men will be bred, unconsciously to themselves, into subordination, an understanding that they *must* obey, and a state of rest. These bring contentment. A regulated contentment brings a better morale. With a better morale there comes less liberty-breaking.

Where there is a regulation not enforced, no matter how trivial the particular, it works great harm, in that it is an example to the men (and to the officers) that you don't exactly mean what you say in such and such a case, and if you don't mean what you say in such and such a particular, why perhaps you don't mean what you say in a lot of other regulations. Thus the man will unconsciously reason, and thus comes about a wide disregard of law, regulations and orders in general, and the commission of offenses purely because of lack of discipline.

With a thorough organization and sane ship's regulations covering all details, most minor reports and casual liberty breaking disappear from the mast, and there is left only malignant liberty breaking to be dealt with, and occasionally a case where the man "just took a chance" of violating some regulation of interior discipline.

Liquor on board ship has about disappeared. So has ship jumping where the liberty is frequent and well regulated.

I heartily agree with Captain Fullam that the Summary Court Martial punishment schedule is inadequate and does harm. An excellent principle

of discipline is to do all you can for the man who never requires punishment and come down hard on the man who demonstrates that he does.

With heavier penalties applied with discretion, there would be less summaries. We never make enough distinction between the man who never commits an offense and the man with the record smeared throughout the four years with offenses and punishments. Most of them seem to get "honorable discharges," testimonials of "fidelity and obedience," and in this view there is but little material incentive for a man to keep his record clear.

Each type of liberty breaker should get its own kind of treatment. I am not in sympathy with any ship's punishment schedule that gives, automatically and mechanically the same punishment for breaking liberty, let us say, to take the extreme, to the petty officer first class and the mess attendant. I think that each class of petty officers should be distinguished from the other classes of petty officers, and that more also should be demanded of C. S. C. men than of first enlistment men. All of this takes pains and thought and care, but the matter in my opinion merits the most painstaking study.

Liberty breakers can be assorted into the following types:

Type I—Casual liberty breakers.
Type II—Confirmed liberty breakers who are first enlistment men.
Type III—Confirmed liberty breakers who are C. S. C. clean sleevers.
Type IV—Confirmed liberty breakers who are C. S. C. petty officers.
Type V—Trained liberty breakers.

The Type I (casual liberty breakers) is generally to be found among the younger men. They may break liberty every few months, and usually are not absent over liberty many hours. They are not drinking men, so have not that excuse, but they break their liberty in cold blood from disregard of law, regulations and order in general, and because they learn to break liberty from older men. This type is intermixed with Type V, is a class of Type V. The records of this type show usually a string of minor deliquencies, for many of which the youngsters themselves are not to blame, but rather the slackness of the service discipline; and all the delinquencies of this type including liberty breaking will materially diminish if their morale is improved by attention to matters of ordinary ship's discipline. They are so young that they easily go wrong if not held strictly to an observance of all regulations, and they easily can be kept right under strict ship's breeding.

In this type will be found many youngsters of excellent stuff. These need only a strong hand over them and a manifestation of official interest in them and they can be moulded into man-o-warsmen of fine quality.

In this type also will be found the shiftless youngster who doesn't care whether school keeps or not, who lacks the element of self-respect essential in the process of breeding a well-disciplined man. These youngsters are the kind that works the navy for a soft thing, that kicks about the grub. Given an inch they go the limit, and are always to be found trying to do as they please, to wear any uniform they please, to smoke where they like. passing officers on shore without saluting and doing endless other insubor-

dinate things. Some of these can be pointed straight by a short course of vigorous disciplining. A few are hopelessly incorrigible and should be discharged as such, for their retention in any ship works endless harm.

This Type I, unless disciplined, eventually becomes Type III.

Type II, confirmed liberty breakers who are first enlistment men.

In this type are older men who enlist at the recruiting offices and thence go to a guardo before being drafted to sea. In the guardo these men get no training worth calling as such; and when they arrive in the man-o-war they are nothing else but merchant sailors in a man-o-warsman's uniform. These men have thrown themselves into the navy as in an inebriate asylum and they should be thrown back into civil life when their unreliability is demonstrated. Those of this type of liberty breakers who are artificer petty officers have a bad demoralizing influence. It is this type, wearing the chevrons of a petty officer first class, we will say, with no training, with no idea of the responsibilities that ought to carry with the chevrons of a petty officer first class, with no idea of commanding a squad of men, it is this type that makes one sometimes think that we cheapen our petty officer ratings by being too promiscuous with them. Perhaps we could do better, reserve the petty officer ratings for the men who can be petty officers, and not give them for ability as specialists merely. Let us try more to breed our specialists *in the ship* rather than seek them from civil life.

Type III. This type, the confirmed liberty breakers who are C. S. C. clean sleevers, is bred from both the Type I men who re-enlist and the Type II men who never get to be petty officers. This type exists because of giving Type I and Type II liberty breakers "honorable discharges," "testimonials" with four months' pay. Some of this type are redeemable, but to redeem some it is necessary to treat them all with just severity, and to make an example to some by bad conduct discharging the worst. Those of this type who intend to stick to the service will respond to discipline. Those who don't intend to stick to the service are not amenable to any discipline, and the sooner we are rid of them the better, for while they are in the service they have a very bad influence over young men just from the training stations (or as these stations should more accurately be called, the Recruit Depots).

Type IV. Confirmed liberty breakers who are C. S. C. petty officers. This type is almost wholly derived from perpetuating by re-enlistment Type II liberty breakers. The tremendous demoralization and cheapening of the petty officers' chevrons wrought by this type is justified by the service because "they are good workers aboard ship." This antiquated service idea is found expressed in a very bad regulation, paragraph 8 of Article 1693, frequently invoked by revising authorities, whereby Summary Courts are admonished not to break a petty officer for "overstaying leave." Happily there is a tendency towards wiping out this wrong notion, for paragraph 11 (page 4) of Bureau of Navigation Circular of October 1, 1910, admits that liberty breaking is a bar to promotion. We should go farther. We should wipe out paragraph 8 of Article 1693 and break the petty officer who is a liberty breaker. And further, as fast as he keeps on breaking liberty he should keep on being broken even down to apprentice seaman, or coal

passer or landsman. No rating must be allowed to be considered a vested right. To take away a man's stripes, to reduce him in the levels among his shipmates I regard as the severest and most convincing punishment, the one which will most surely bring about discipline. There are lots of fine youngsters ready and able and waiting to step up in the scale, and *reduction in rating* vigorously applied to the confirmed liberty breaker is the most potent of all punishments, of that I am convinced. I have no hesitation in saying that it should be applied to seamen and firemen first class where necessary to reach such men who are giving less than value received by reason of absences from duty on account of overstaying leave and the ensuing procedures. Reduce a few seamen to ordinary seamen and firemen first class to firemen second class and the Type I and Type III liberty breakers would sit up and take notice.

Type V. The *trained* liberty breakers. For this type the slackness of discipline in the service is altogether to blame. To this type belong those youngsters who, having come into the fleet from the training stations well disciplined and with clear records and fine promise, actually are *trained* to break liberty by association with and example of all the before-mentioned types of liberty breakers who are rather tolerated and accepted than corrected and eradicated. Go to one's office and take down any number of records and one will see that this statement is correct. It is startling to realize that there is at the training stations a discipline that keeps men's records clear, and in the fleet a lack of discipline that manifests itself by bad records.

While I have affirmed that the discipline is not good, I wish to be understood to mean simply that more attention to elementary discipline would reduce liberty breaking. I have the greatest faith in the possibility of making our discipline superb, and I am a firm believer with Captain Fullam that we can make our men what we will. We have so many splendid men in the service that it is a shame and a pity that we hang on to a few sots and unreliables only to degrade the great majority. Therefore I think that each of these types of liberty breakers should have its own peculiar treatment, that the punishment a man merits should be based, not on a schedule thought to fit all, but on a study of the *type* of liberty breaker one has to deal with. Undoubtedly the Summary Court punishment schedule is ridiculously lenient, and its very leniency breeds more summaries. The *laws,* that is, the statutes, are splendid. They provide ample and adequate punishment. But the regulations have gone too far in tying the hands of the captains in inflicting the *lawful* penalties. Under the *statutes* captains have full swing in penalties if they are permitted to inflict them. I say captains, because I take the ground that as the captain is responsible for the discipline, it is the duty of the Summary Court officers to adjudge a punishment deemed appropriate by the captain, and as a Summary Court senior member I have always laid this view before the captain—that while the court would be guided by its *conscience* in the finding, it would be guided by the captain in its sentence. And so, under the law, the state of a ship's discipline reflects the character of the captain as a seaman and as a disciplinarian, and depends on his habits, tempera-

ment, personality, example and knowledge of men. While one scheme and schedule might be best for one ship under one captain, the same might not be so well applied in another ship under another captain. I agree, that as standards go, it were better could all ships standardize punishments, but that can not come about until we standardize captains; and I agree emphatically that we need more disciplinarians in the service, and a more vigorous application of the law. But on the other hand, the very limitations imposed by the regulations in applying the lawful penalties have probably operated to stifle some captains in attaining good discipline; for if these regulation limitations are good, why did not the splendid seamen who wrote the laws into the statute books a couple of generations ago put them in the laws? Probably because they knew that as the captain should be the "priest, prophet and king" to his men, so on the captain ultimately depends the discipline of his command, and the amount of liberty breaking.

LIEUT.-COMMANDER W. T. CLUVERIUS, U. S. Navy.—I am glad to see Captain Fullam's opportune article. It is high time that this ingrowing evil be eradicated, for absence over leave in the battleship fleet is malignant. Its influence is far-reaching, for it not only attacks discipline and creates disregard for authority, but imposes restrictions upon the scope of endeavor of the ship, the division, and the fleet. Captain Fullam has brought this point out, and not one whit too forcibly. The conditions are recognizable to all of us. Nothing exasperates one more than having to get work done with a chronic set of liberty breakers to do it. What is there to prevent other factors of unreliability from entering into the make-up of the ship's crew if this one so generally obtains, and who can forsee the effect of an unreliable personnel in action?

Captain Fullam says the offense prevails through lack of determined effort to stop it. Concerted determined effort, I would say. His paper is timely, because this is the day of standardization, and the handling of liberty breaking is bound to be standardized, and I am convinced that this will result in its sensible reduction. If determined effort will stamp it out in one ship, concerted determined effort will remove it from the fleet.

Captain Fullam presents a method. It is based on his analysis of the cause and spread of the offense. His method works. I have seen it operating under all varieties of conditions, and with all sorts of men. I have never seen a ship's company return to duty in better trim of mind and body than the *Mississippi's,* or tackle the day's work more cheerfully, or stick to it better, with liberty neither present nor prospective. Records can show a good deal of this, and it is my belief that this ship has been a "happy" one, which means much. I saw the method applied to a battleship in reserve, with a crew of 400, and acting also as a receiving ship. A large number were new men being broken in for battleships and destroyers about to be commissioned. There were many general detail men, drifting in and out, and her own skeleton crew made up the complement. This heterogeneous assortment had no initial interest in this particular ship. That the liberal liberty given was appreciated and was recognized as a privilege was plainly indicated, for the daily reports rarely showed more

than one absentee. The plan was taken up later by a gunboat cruising under the uncertain conditions of duty in the West Indies and marked success resulted.

The proposition is a square one. It is not necessarily new, and it is met more than half way. That a definite punishment attends abuse of its liberal features is well understood. It is productive of a good return of labor, for the enlisted man soon grasps the fact that "he must be on his job to hold it."

LIEUT.-COMMANDER D. W. KNOX, U. S. Navy.—Referring to the advance copy of an article entitled "Absence Over Leave in the Fleet," by Captain W. F. Fullam, U. S. Navy, received by me with the request for a discussion, the following is submitted:

1. The author's analysis of the *bad effects* of liberty breaking, striking as it does at the fundamental principles of duty, is extremely clever and carries conviction.

2. The article will undoubtedly do a great deal of good towards making the service at large appreciate the seriousness of the offense, which, it is believed, has not heretofore been thoroughly recognized.

3. The principle of the "free gangway" is undoubtedly sound, as well as that of severe punishment for transgression against liberal privilege.

4. But it should be remembered that the true origin of liberty breaking is debauchery. This latter is fostered by the "feast and famine' methods of work and play, which, though not as acute as formerly, still obtain to an undue degree.

5. Our first enlistment men are fine raw material and rigid effort should be directed towards making decency a habit easily to be acquired by them. Unfortunately we are well stocked with debauchees. Those who find great gratification in the large number of re-enlistments do not take into account the fact that a large proportion of these men could not hold a job in the Pennsylvania railroad because of their habits. We refrain from drastic weeding out of habitual liberty breakers (who are debauchees whether or not it shows on their record), because of the tremendous demand it would make on a recruiting service already strained to the limit.

6. While the remedy for liberty breaking practiced by Captain Fullam tends to reduce debauchery, it does not, in my opinion, strike sufficiently deeply into the root of the evil to promise permanently satisfactory results.

It aims only at making the best of a bad condition, whereas the correction of the condition itself is preferable. "Free gangways" and "severe punishments" are but incidentals in a more comprehensive reform which will be suggested by a closer examination into the *causes* of our troubles than is made in the article under discussion.

7. At present we are chiefly deficient in morale, which has been defined as "cheerful willingness to do the utmost." It is probably three times as essential to war efficiency as proficiency in the manipulation of material, to which of late years we have been giving such paramount attention.

8. Morale is based on contentment. Other factors, such as interest, enthusiasm, subordination and loyalty must be included in its definition;

but these cannot reach a high development unless thoroughly fertilized by contentment, which does not now exist to the proper degree among officers or men.

9. In order to secure reasonable contentment, it is vital that the administration of the service be such as to permit the personnel afloat to lead more normal and regular lives; comparable to that led by the average good citizen on shore. While it is unnecessary and perhaps undesirable to unduly encourage matrimony for the enlisted personnel, at the same time it must be recognized that of those who are the most worthy and the most valuable to the service, the major portion will sometime in the natural order of events desire to marry. They are then forced to choose between leaving the service or leading a very abnormal life. But whether or not a man marries, his contentment and his moral inclinations are fostered by regularity of life and by frequent substitutions of play for work and vice versa.

10. The remedy may be found in establishing a permanent "operating base" for each fleet within reasonable distance of one or more large cities, at which eight or nine months of every year will be spent. It may be observed incidentally that the British and Germans have followed this practice for a number of years.

11. The establishment of such a base would permit men and officers to settle their families or relatives permanently with a prospect of seeing them each week-end during most of the year. The three or four months each year away from the base may be employed in a foreign cruise or in such other work as may be desirable, with beneficial effect on the morale of "roving spirits," and without impairing that of men whose families are settled near the "base."

12. It is desirable though not essential that there be at such an "operating base" recreation grounds for all kinds of sport and athletics, billiard halls, reading rooms, etc., similar to those found at many British and German naval bases.

13. It is believed that the adoption of such a plan would strike at the very root of liberty breaking, debauchery, immorality, desertion of good men, failure of good men to re-enlist, the necessity for excessive recruiting, inadvisability of a more thorough weeding out of drunkards, lack of permanence of personnel, and many other difficulties which are encountered at present.

COMMANDER C. B. BRITTAIN, U. S. Navy.—Referring to the paper by Captain Fullam on the subject of liberty breaking and remedies for it, I consider the paper a most timely one, and the matter one that should receive the harmonious effort, not only of commanding officers, who, working together, could do a great deal to remedy the evil, but this working together or united effort on their part should be brought about by well considered action of the Navy Department itself. This is perhaps the only way that united and consistent effort among captains could be brought about. Action by the Department regulating the monthly payment of men was an effort most successful and cured that evil which, only a few years ago, was perhaps the greatest of evils in causing discontent among the enlisted men and giving rise to breaches of discipline

born of this discontent. In May, 1910, when placed in command of the U. S. S. *Massachusetts*, I put into effect, as regards liberty breaking, a system practically identical with Captain Fullam's. It worked splendidly. In October of that year I further revised my system to make it more nearly identical with Captain Fullam's, which I had then learned about in some detail; the *Massachusetts* was then in reserve and the results were still excellent. When I took command of the *Wheeling* in January, 1911, I continued this same system, and in the eleven months that I have had command of the ship, liberty breaking has been an exception rather than the rule. The system not only adds to the efficiency of the ship and to the moral tone and self-respect of the personnel—commissioned as well as enlisted, for it hurts the pride and self-respect of everybody to see wholesale and uncondoned liberty breaking—but also adds to the contentment and real happiness of the men, for they, as well as the officers, like to belong to an efficient and well disciplined ship.

A New Method of Teaching Swimming, with a Few Hints on Rescuing the Drowning.

(See No. 139.)

MR. WILLARD C. TYLER.—This officer's amusing method of learning to swim in one lesson might well be tried by all who are unable to learn this easy accomplishment. His directions for breathing in rough water ought to be instinctive with everyone not a fool, but unhappily it is not. The advice is valuable to all inexperienced persons who find themselves in rough water.

In saving the drowning, an experience of the writer's should be of value to all who are called upon to assist these helpless people and may be the means of saving two lives, viz., the helper and the helped.

I have always been a strong swimmer, having learned as a boy in a Massachusetts fresh water river. Many years ago the duty fell to me to go to the assistance of a person drowning in about 20 feet of salt water. Through carelessness or the ignorant method of my approach this person got her arm tight around my neck, absolutely shutting off my wind, and our case was desperate. Everything went black and I felt that we both were lost. Just then an inspiration came to me, that a drowning person will not cling to a sinking object until the last death grip comes. It's contrary to all natural law. So I ceased all effort and we both went to the bottom. Just as my feet touched, to my unspeakable relief the grip around my neck was relaxed and we parted company. The rest was easy; I struck for the surface at sufficient angle to go clear, got some breath and, having more sense that time, got hold of one of the feet of the other person and towed her ashore, spread-eagled on her back, in safety. I was quite used up at the finish, but soon recovered my breath and was all right.

The point of the above is, that, if a drowning person gets too strong a grip on you, *and has not been down twice before, take them down, or to the bottom and they will let go.*

This is my belief from that experience and I would be glad to know if it is confirmed by others?

PROFESSIONAL NOTES.

Prepared by Lieut.-Commander W. B. Wells, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINE REPUBLIC.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Rivadavia	28,000	Fore River Shipbl'dg Co.	Launched Aug. 26, 1911.
Moreno	28,000	New York "	" Sept. 23, 1911.

Moreno Launched for Argentine Navy.—The Agentine battleship *Moreno*, planned to be one of the most formidable *Dreadnoughts* in the world, was launched this afternoon from the yard of the New York Shipbuilding Company at Camden, N. J.

The keel of the ship was laid on July 9, 1910.

The only other vessel now afloat equal to the *Moreno* is her sister ship, the *Rivadavia*, recently launched by the Fore River Ship Building Company at Quincy, Mass. The *Moreno* represents the latest development of the 12-inch gun battleship. She is greater in point of length and displacement than the *Utah* and *Florida*, the largest ships in the American Navy.

According to the builders the *Moreno* and *Rivadavia* are even larger than the *New York*, the keel of which was recently laid in New York, and which will have a displacement of 27,000 tons. British designers are working to oustrip these vessels, planning the *Queen Mary* with a displacement of 29,000 tons.

The *Moreno* will carry twelve 12-inch guns. Her American peers in this respect are the *Arkansas*, built in Camden, and the *Wyoming*, constructed by the Cramps in Philadelphia, neither of which are yet in commission; the Austrian *Viribus Unitis*, the German *Thüringen*, the Japanese *Kawachi*, the Russian *Sevastopol*, the Brazilian *Sao Paulo*, the Italian *Dante Alighieri*, and the French *Courbet* and *Jean Bart*. The *Jean Bart* was launched September 22, 1911.

The next step forward in battleship building, so far as armament is concerned, is a reduction of two in the number of main guns, at the same time increasing the caliber to 14 inches. The *New York* will have ten 14-inch guns. A ship in the same class is under construction in Great Britain.

The speed of the *Moreno* will exceed vessels of her class which average 21 knots an hour. The *Moreno* under her contract, will have to reach 22½ knots. She is expected to develop 40,000 horse power. The engines of the *New York* are designed for 32,000.

The *Moreno* and *Rivadavia* are 595 feet long over all, while the *Utah* and *Florida* are 521½ feet. The Argentine ships have a breadth of 98 feet, and will have a normal draft of 27 feet.

The contract for the two ships was awarded to the Bethlehem Steel Company, which sublet the work of construction. The Bethlehem Company is supplying the armor and armament for both ships. Each battleship will cost about $12,000,000.

DIFFERENT TYPES OF TORPEDO-BOATS.—The Argentine government has let contracts to foreign shipyards for the construction of a certain number of torpedo-boats. These contracts have been divided among the French, German and English shipyards. It is to be noted that these boats are to be heterogeneous in their exterior design, following that of the shipyards in which they are to be built. Thus, in the French type, the keel line, which does not extend to the stern, curves upward suddenly, while the *Catamarca* and the *Jujuy*, built in Germany, have a keel line continuing horizontally to the stern. The design of the stern in the French type has the advantage of diminishing the resistance of the bottom, and consequently of affording a greater speed.

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Radetsky	14,500	Trieste.	Under trial.
Zrinyi	14,500	"	Launched April 12, 1910.
Erzherzog Franz Ferdinand.	14,500	"	Under trial.
Viribus Unitis	20,000	"	Launched June 24, 1911.
V	20,000	"	"
VI	20,000	"	Contracted.
VII	20,000	Fiume.	"

CHILI.

A contract has been signed by the Chilian Minister with Messrs. Samuel White, of Cowes, for the construction of six new destroyers for the Chilian Government. The vessels will cost about £1,000,000.—*Shipping Illustrated.*

FRANCE.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Courbet	23,500	Lorient.	Launched Sept. 23, 1911.
Jean Bart	23,500	Brest	" Sept. 22, 1911.
France	23,500	St. Nazaire.	Authorized.
Paris	23,500	La Seyne.	"

SPEED OF BATTLESHIPS.—The 18,400-ton *Danton* and *Condorcet* and the 14,000-ton cruiser *Rousseau*, have arrived at Toulon, having accomplished the Brittany-Toulon run in 99 hours—34 hours at 17 knots and 65 at 16 knots. Although no attempt was made by Admiral de Lapeyrère to force his new ships or to establish a record, this voyage, accomplished under easy conditions, constitutes all the same a creditable performance and will help to confirm the high reputation which French battleships have enjoyed for steaming since the seven days' run at over 16 knots (Brest-New York, 1909) of the Le Pord division (*Liberté, Justice, Verité*). Battleships whose continuous sea speed is within two knots of their designed speed must be pronounced a success in the matter of steaming! The Parsons turbines gave entire satisfaction. The only unsatisfactory points mentioned

are the abnormal quantity of smoke produced by the five funnels (!) of the *Dantons* and the six funnels (!) of the *Rousseau,* and the rather heavy coal consumption, 357 tons per day for the *Dantons,* 363 for the *Condorcet.—The Naval and Military Record.*

THE FRENCH NAVY.—The French Naval estimates for 1912 have recently been submitted to the French Budget Commission. The outlay proposed for the year is 17,070,322*l.* The credits actually voted for 1911 amounted to 16,657,225*l.* The increase proposed for 1912 is, accordingly, 413,097*l.* The expenditure of 17,070,322*l.*, set against 1912 does not, however, include anything for the construction of the fifth and sixth ironclads, which, according to next year's French naval program, should be laid down during the year. If the program is adhered to as regards these two ironclads, a further outlay of 275,585*l.* will be required.—*Engineering,* October 13, 1911.

EFFICIENT GUNNERY.—Much satisfaction has been elicited in naval circles at the creditable performances the Deuxième and Troisième Escadres have achieved during their recent battle practice, against fixed targets, off the Hyères Islands. The high percentage of hits obtained (up to 57 per cent) testifies to the growing efficiency of fleet gunners, especially as the range, usually 6000 to 7500 meters, had been increased to over 8000 meters, in compliance with the instructions of Minister of Marine Delcassé, who aims at introducing gradually in the Gallic Navy the realistic and progressive methods of the British and American fleets. The test afforded an opportunity to compare together, from the point of view of battle efficiency, the Brest and Toulon squadrons, which were called to give a measure of their firing ability under conditions alike for both. As was to be expected, the Northern Escadre, used to training in the choppy waters of the Atlantic, had no difficulty in asserting its superiority over its southern rival, which is much wanting in sea practice, and has long had to spend its time between Toulon harbor and coastal cruises at economical speed (a course quite obligatory in these times of dear Welsh coal!) in the usually calm waters of the "Golfe de Lion."

The battleship *Justice* nearly beat with her big guns her record of 50 per cent hits (60 per cent during the first four minutes) of last year. Afterwards in order of merit come the battleships *Gaulois, Charlemagne, Démocratie* (that has long detained the gunnery cup), and *Jaurèguiberry.* Of these six vessels, four belong to the Brest Squadron, a significant fact that has not escaped the attention of French naval men, who are more than ever, since the *Liberté* disaster, of opinion that the right and normal place for a fleet is at sea. Also the successful ships have all fine records to maintain, which points to strenuous work and to keen emulation among the personnel. It is obvious that the "gunnery fever," introduced by Admiral Germinet in the battle force, has not yet subsided, and the results obtained show what the Gallic fleet will achieve once it has better powder and has adopted the British custom of practicing under all conditions of weather. Very judiciously, Mons. Delcassé has decided to reward with promotions and distinctions the zeal and competence of the successful gunnery staffs.—*Naval and Military Record.*

SHIPBUILDING WORKS AT LA SEYNE.—The French shipbuilding firm which is known as Les Forges et Chantiers de la Mediterranée occupies, owing to the number and size of its shipbuilding slips and its up-to-date equipment, a foremost position among the French shipbuilding undertakings. It has establishments at La Seyne, Marseilles and Havre. That at La Seyne was founded in 1857, and in it shipbilding only is carried out. It, together with an engine works at Marseilles, is known as the South Works. The North-West Works at Havre include engine shops as well as a shipbuilding yard.

Both yards are equipped with facilities for the construction of ships of all sorts, from the small torpedo boat to the big battleship. Large numbers of vessels, both naval and mercantile, have been constructed in them for the Brazilian, Chilian, Greek, French, Japanese and Russian navies. Among the most important may be mentioned he two French battleships *Patrie* and *Justice* of 15,635 tons each.

The main establishment of the Forges et Chantiers de la Mediterranée is at La Seyne, and it is our intention to describe it alone in the present article. It covers 22 hectares (=55 acres), with a frontage of 1200 m. (=3940 feet) to Toulon roads. At the center of the yard is a fitting-out dock, 135 m. (=443 feet) in length, and 35 m. (=115 feet) in width, with a sufficient depth as to accommodate the largest ships which will be built for many years to come. The head and drawing offices are housed in a big building facing the fitting-out dock. The drawing office staff consists of no less than 150 men. There are seven slips, two of which have an available length of 200 m. (=656 feet), and are built of masonry. Plates, beams, etc., are hoisted over the slips by powerful revolving electric cranes. The total covered area of the works is of 50,000 square meters (=54,680 square yards), a noteworthy figure for a yard lying on the Mediterranean coast, where seasons are not severe. There are five main departments in this yard. They are as follows: The smith's, wood-working, artillery and armament, turbine and boiler departments.—*The Engineer.*

CHANGES IN THE FRENCH NAVAL COLLEGE.—There is now in progress a very important change in connection with the French Naval College, which is devoted to the training of naval officers. Interest is added to this change which, in the first instance, is one of locality, by the fact that it unquestionably paves the way for more considerable alteration, not only in the program of admission to the school, but especially in the education and training of officers, somewhat on the lines followed in various foreign countries.

It will be remembered that, prior to 1839, the school—or, to be more exact, the Royal College, which served to train the future naval officers—was situated in Angoulême, in the interior of the country. It is true that from 1827 the college was completed by a training-ship for pupils who were finishing their special studies, while towards the end of 1830 the naval school was installed, and up to the present time has remained, on board a vessel anchored in the roadstead of Brest. Various ships have succeeded each oher in thus affording shelter to the naval school and its pupils, and since 1841 the two vessels which have been assigned for his duty have successively taken the name of *Borda.* It is for this reason that in naval circles the school is known as "Borda." The ship which now accommodates the school—always in the roadstead of Brest, and always under the same conditions—is an old transport formerly called the *Intrepide* which was appointed to this service in 1889. Needless to say, the *Borda,* to call it by its generic name, in spite of the quiet which it enjoys in the sheltered roadstead of Brest, is becoming very old and decrepit, for, before being used for a naval school, it had done service as a transport. It is now forty years since it was first navigated.

It has therefore become absolutely essential to replace this vessel; which might be done either by substituting a new ship for this old *Intrepide,* or merely by installing the naval school elsewhere. The latter course is the one which has been decided upon, and the decision to abandon the classic ship anchored in the roadstead of Brest is duè to Admiral Boué de Lapeyrère. Admiral Boué de Lapeyrère has brought to his Ministry a special knowledge bearing upon this question—he was formerly Maritime Prefect at

Brest—and he has been able to make clear the state of decay of the *Borda*, and the inconvenience which would result from continuing the naval school, in its enlarged, transformed, and improved state, in a boat which is necessarily too small for the requisite practical installations. It is certainly difficult to arrange on board a ship, be it what it may, for the commodious spaces required by the scientific and experimental education which it is now proposed to give to naval students. Moreover, where the pupils are numerous, hygiene is seriously sacrificed on board such a ship. In establishing a school on land, however, it is a simple matter so to construct new buildings that they are well adapted for their purposes, and afford the best conditions for health, as well as for the instruction of future officers.

Complete plans have now been prepared of the building about to be erected for the lodgment of the school and its pupils, and it is estimated that this building will be completed in two or three years, although it is probable, as almost invariably happens in such matters, there will be some delay. This naval college on land—a novelty for France—will be built on the rocky promontory which terminates the right bank of the River Penfeld, upon which is erected the naval arsenal of Brest. The plans of the new school have been based on the detail suggestions furnished by an officer who best understands the needs of the case; that is to say, by the present commander of the *Borda*, or naval school. The school will be built on an upland of about 4 hectares (10 acres), to which it is intended to annex a piece of land of about 10 hectares (24¾ acres), planted with trees. This latter will constitute a park for exercising the corps, and for promenades for the students, and will accordingly afford the best hygienic conditions. These two pieces of land, now to belong to the school, will be separated by the moat of the Brest fortifications, and the moat itself will be utilized for the purpose of games, to which adequate attention will be paid in the future scheme for the occupation of the students' time. The buildings will comprise three parts, one of which will be a large round pavilion, containing the dining-room, and overlooking the roadstead and the commercial port, etc. It will be possible, in this new school, to install all the requisites which hygiene demands—bath-rooms, shower-baths, lavatories and dressing-rooms, which could not, without difficulty, be provided in the holds and store-rooms of the old boat which now serves to lodge the naval officers' school. In the dormitories, according to present intention, the hammock, the old classic bed of the ships of former days, will be preserved. Large rooms containing models will be installed, together with chemical and physical laboratories, for the instruction of students, in order that they may become scientific and completely equipped officers. Modifications have already been introduced into the program of the naval school in the direction of making it more severe. The authorities even contemplate—although, in our opinion, this would be going too far as yet—changes in the program for the entrance examination; this program would approximate to that of the Polytechnic School, and would embrace a larger proportion of special mathematics. This kind of knowledge which has not always proved of special advantage to the mining and bridge engineers, and other functionaries, turned out by the Polytechnic school, would be dearly acquired if it interfered with the practical training of the naval officer of the future.

It is quite understood that while the future naval officers will be established on land, they will be kept in intimate contact with the sea and the ships, and with all practical applications. Having in view the advantage of practical studies, visits will be paid to the arsenal, which will be a near neighbor of the school, and these should prove very profitable; especially visits to armored vessels of every type, which either stay in or pass along the roadstead of Brest. The students will thus be able to acquire a precise knowledge of naval and military material in every form, whereas they could learn nothing of this in the old ship in which

they have been, and are at present lodged. They will be regularly required to maneuver a modern protected cruiser, no longer using for this purpose the old-fashioned despatch vessel, which they now move up and down the roadstead from time to time. Every three months they will go out to sea in the protected cruiser, and they will, in particular, navigate the waters of the Gulf of Gascony, where they will make acquaintance with a sea which is almost always disturbed, and also with a true sailor's life. Moreover, their practical maritime education will be completed by navigating and service in craft of all sorts, especially a certain number of torpedo-boats, which will be placed at their disposal. At the present time, in order to familiarize them with the sea and the officer's life, the students of the *Borda* are placed on an old transport called the *Dugay-Drouin,* in which, on leaving the school, they make a cruise, but in which there are no modern appliances. When the alterations to which we have referred have become effective, the students, their school training ended, will embark on a fine armored cruiser. This boat will probably be the *Jeanne d'Arc,* of 10,000 tons, capable of steaming 23 knots, with three engines developing collectively 28,000 horse-power. This boat, moreover, is provided with artillery in the turrets and casemates. It will constitute a school of practical application.

The students leaving the college to become officers will thus receive technical and military instruction which will correspond to the need of modern life, and the young officers will then be able to carry out certain duties from the moment they embark. It should be mentioned that even now, under the control of the present commander of the naval school—badly equipped as that school may be—the pupils have succeeded in getting into touch with modern practice in navigation. They have thus learned to manage torpedoes, and, in a recent inspection, the inspecting vice-admiral made an experimental trip to sea on a destroyer which was armed and equipped solely by the pupils of the naval school. All the duties on board were executed by the students, as well for maneuvering the craft as for working the engines and stoking, with the aid of coal-trimmers who were also no other than future officers. In this there is instruction of the most valuable kind, which should be enlarged and continued. The transformation of the French naval school, from the point of view of material, will undoubtedly bring about a modification in the training of future officers, and in the spirit which dominates their education. As in England, the United States, and Italy, the French naval authorities are seriously considering the abandonment of a system which places on board two sets of officers absolutely different, the one occupied with navigation and the means of combat, the other with the management of machinery. It is more than probable that, in view of the practical direction which will be given to the school on land, with its new laboratories and perfected means of study, a single body of naval officers will be established, who will unite all the special qualifications required in crews, as well those of mechanics and stokers, as those of combatants, boatmen, gunners, and torpedo-officers. Now there are, below the naval officer properly so described, men who are called "adjutants principaux," who have specialized in a particular trade—mechanic, gunner, or torpedo officer, and who, having "achieved" their rank, are capable of attending to certain details of which it is possible to relieve the naval officers. In this relation, the Minister of Marine has quite recently announced his intention to create a body of officers of the crews of fleets who will be concerned with part of the minor duties now required from officers properly so called, and who will have a position distinctly superior in authority and advantages to that of the present petty officers. We have here then, altogether, an assemblage of changes, some of which have already accomplished and appear likely to yield good results.—*Engineering.*

GERMANY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Oldenburg	22,440	Danzig (Schichau).	Launched June 30, 1910.
Kaiser	24,000	Kiel (Kaiserliche W.).	" Mar. 22, 1911.
Friedrich der Grosse	20,000	Hamburg (Vulkan).	" June 10, 1911.
Kaiserin	20,000	Kiel (Howaldt).	Building
König Albert	20,000	Danzig (Schichau).	"
Prince Regent Luitpold	21,000?	Germania Works.	"
Ersatz K. Friedrich Wilhelm			Authorized.
" Weissenburg			"
" S		Wilhelmshaven.	"
Armored Cruisers.			
Goeben	22,600	"	Launched Mar. 28, 1911.
J	25,000	"	Building.
K	25,000		Authorized.
Protected Cruisers.			
Breslau	5,400 ?	Stettin (Vulkan).	Launched May 16, 1911.
Magdeburg	4,500 ?	Bremen (Weser).	" May 13, 1911.
Ersatz Cormoran	4,500 ?	Bremen (Weser).	" Nov. 4, 1911.
" Strassburg	4,500 ?	Wilhelmshaven.	" Aug. 24, 1911.
" Seeadler	5,500	Germania Works.	Building.
" Geier	5,500	Howaldt.	"

THE KAISERIN, NEW WARSHIP, LAUNCHED.—Kiel, Saturday, November 12, 1911. The new battleship which replaces the old *Hagen* was launched today in the presence of Emperor William and Empress Augusta Victoria and christened the Kaiserin by Princess Victoria Louise.

Grand Admiral von Koester, who was second ranking officer in the international fleet assembled at New York for the Hudson-Fulton celebration in the fall of 1909, made the speech of the day.

The new warship, he said, was intended to help maintain an honorable peace, which was desired by the German nation, but should war come the *Kaiserin* would be found like Her Majesty's sons, who were always ready joyfully to offer their lives for the fatherland.

The *Helgoland,* which is the battleship of corresponding date to the *Moltke,* appears to be a very distinct improvement on the *Nassau* class, and possesses at first sight a much less cumbrous exterior appearance, more in keeping with that of a cruiser, unless she is seen end on, when the immense breadth becomes very striking. To the English eye the masts appear very light, but then the Germans accept bridge-level control platforms, and only signalling is necessary to arrange for.—*Engineering.*

GERMANY'S NEW DREADNOUGHT.—By the commissioning last August of the *Helgoland* Germany now possesses a *Dreadnought* squadron of seven battleships. The *Helgoland* is a sister ship of the *Thüringen* and *Ostfriesland,* and these, with the unfinished *Oldenburg,* form the class of super-*Dreadnoughts.* The *Helgoland* was laid down at the Howaldt yard, Kiel, in December, 1908, and launched in September, 1909, so that her construction period has been about 33 months. Her length is 546 feet, breadth 93 feet 6 inches, draft 26 feet 10¾ inches, and displacement 23,133 tons. She is propelled by triple-expansion reciprocating engines, calculated to give a speed of 20.5 knots. As compared with the earlier ships of the *Nassau* class the *Helgoland* displaces an additional 4000 tons. The armament is also heavier. The *Helgoland* carries twelve 12-inch (*Nassau* 11.1-inch) guns mounted in six turrets, fourteen 5.9-inch,

and fourteen guns of smaller caliber, along with six torpedo tubes. Usually she will carry 900 tons of coal, but the quantity can be increased to 3000 tons if necessary.

The German battlecruiser *Moltke,* which underwent her contract steam trial last week, is reported to have attained the record speed of 29½ knots, though for how many hours is not stated. This cruiser is a sister ship to the *Von der Tann,* and has been built by the same firm. She was laid down in April, 1909, launched one year later, and should be ready for service next month—a period of 29 months from the laying of the keel. The maximum speed of her sister ship is believed to be 28 knots, or a trifle less. It is given in the *Navy League Annual* as 27.63. The much higher speed stated to have been maintained by the *Moltke* can only be explained by the horse-power being in excess of that of the *Von der Tann.* In any case, it was a magnificent performance, and shows that the German engineers have nothing to learn from us. So the competition in horse-power goes on, and it involves an enormously increased outlay upon engines. We set the pace ourselves with our first *Dreadnought* cruisers, and now, presumably, we shall be compelled to produce armored cruisers of 30 knots. However much one may deplore this costly competition in engine design, England cannot afford to allow any rival Power to possess cruisers of superior speed, and for this reason the ensuing trial of the 70,000 horse-power cruiser *Lion* will possess more than ordinary interest.—*Naval and Military Gazette.*

The design of the cruiser *Moltke* has at last been published in Germany, though the details have been public property for a long time. The vessel carries eight twin turrets on the upper deck, disposed as in the *Von der Tann,* as well as the main deck turret aft, situated below the after center-line upper deck one, but for which the vessel would appear very similar to her predecessor. Although she also possesses only two funnels, she is confidently expected to exceed the 79,800 shaft horse-power of the *Von der Tann.* The length on the water line is stated to be 610 feet, which is some 70 feet less than that of the *Lion,* the displacement being 23,500 tons. A full water-line belt is formed and the midship armor is carried up to the upper deck, and covers the 6-inch gun battery of six guns a side. The vessel will proceed on trial during the next few weeks. —*Engineering.*

THE NAVAL PROGRAM.—Germany's Naval Program for the six months between October next and April, 1912, includes the following, says the Berlin correspondent of *The Globe.*

1. Ships to be ready on April 1 next: *Oldenburg* (battleship), *Goeben* (first-class armored cruiser), and *Breslau* (small armored cruiser). All three ships must be in a condition to perform their speed trials at that date.

2. Completion of the armament of the *Dreadnought* battleships *Kaiser* and *Friedrich der Grosse* and of the second-class cruisers *Magdeburg* and *Strassburg.*

3. Continuation of construction, for launching, of *Erzatz-Ægir, Ersatz-Odin,* and *Ersatz-Hagen* (battleship), and of *No. 1* (cruiser).

4. Laying down of battleship *S* and the two battleships to replace the *Kurfürst-Wilhelm* and the *Weissenburg,* the crusier *K,* two small cruisers, and an undetermined number of torpedo-boats and submarines.

CRUISER EXCEEDS 29 KNOTS.—A Reuter's telegram from Berlin says: While on her trials the new German cruiser *Moltke* attained a speed of 29.5 knots.

Berlin, September 9. "In all silence," as the German phrase runs, torpedo-nets have reappeared here, and if present plans hold good every large armored ship will be so fitted. The nets finally adopted, after

a long series of experiments, differ in many respects from the Bullivant variety, being lighter and, it is claimed, more rapidly handled. The four *Nassaus* have already donned their "crinolines," and a like equipment has been given to the three *Ostfrieslands*. It is worth noting that the nets have returned in the face of heated opposition from naval officers, and curious stories are heard of the aversion with which commanders view the innovation. They still maintain that torpedo-nets are a source of danger rather than protection, owing to the extreme likelihood of shell fire wrecking the apparatus and of its becoming involved in the propellors and rudder. These objections deserve consideration, coming as they do from progressive and practical seamen; but it is doubtful whether they will avail against the decision of the authorities.

THE BLÜCHER'S REPUTATION.—Some excellent steaming performances and a record of good behavior since her commission in the autumn of 1909 have done much to reconcile German public opinion to that product of a strange misunderstanding, the armored cruiser *Blücher*. So well, indeed, has this boat shaped under all conditions that in service circles it is doubted whether the Admiralty is well advised in contemplating, as it is reported to be, a change in the armament by substituting single 9.4-inch, or even 11-inch guns for the double fore and aft 8.2-inch turrets. There can be no question that the vessel is structurally capable of carrying heavier weapons, since a certain margin of strength was allowed in the early stage of building, when the Admiralty was still undecided as to what armament should be put on board pending reliable particulars of the British *Invincibles,* which were then on the stocks. At the same time there is a well-grounded feeling that reconstruction, however slight, jeopardizes the speed and other qualities of a ship, and as the *Blücher* has acquitted herself so admirably hitherto, the advocates of leaving well alone may carry their point.

SHIPBUILDING RESOURCES.—Since the echoes of the agitation of 1909 died away little has been heard of acceleration of new construction in German yards, and yet it is a fact that the three battleships of the *Ostfriesland* class have all been commissioned well in advance of the official dates. According to a statement made some time ago by the Marine Administration, the *Helgoland* was due for commission on October 1 as the seventeenth battleship of the High Seas fleet. As a matter of fact, however, this vessel was commissioned on August 23. The *Thüringen* entered the service on July 1, and the *Ostfriesland* on August 1, both several weeks in advance of the dates forecasted. Germany is, of course, rather to be praised than blamed for this evidence of the efficiency of her shipbuilding establishments, particularly as their is every reason to believe that the official laying-down dates were adhered to. As a result of this energy the fleet which was reviewed by the Kaiser this week included seven *Dreadnoughts*. The moral attached to the circumstances is that the potentiality of German yards in the output of warships should not be under-estimated. They are undoubtedly in a position to drastically reduce the present average building period, and if the need arose they could press the best British yards very closely in point of rapid construction.

TYPES OF TURBINES.—The three turbine battleships authorized this year, and for which contracts were recently placed, will each have different machinery installations. The *Ersatz K. Friedrich Wilhelm,* to be built at the Vulkan yard, Hamburg, will be driven by Allgemeine Elektrizitäts-Gesellschaft turbines to be manufactured in the Vulcan workshops. Parsons turbines have been chosen for the battleship *"S,"* building at Wilhelmshaven, though the type adopted in this case differs considerably from the original Parsons system, certain modifications which make for simplicity having been introduced. The batch of six large torpedo-boats constructing at the Krupp Germania yard will have similar engines. In

the case of the *Ersatz Weissenburg,* laid down at the Weser yard, a novelty will be introduced in the shape of turbines constructed by the Bergmann Elektrizitätswerken, of Berlin, for which a great economy in fuel consumption is claimed. Futhermore, the usual cruising turbines are rendered unnecessary. It is thus evident that the Marine Amt has no intention of resting on its oars in the matter of turbine development, albeit the wisdom of introducing so many divergent types of propelling machinery into the navy is open to question.—*Naval and Military Record.*

According to *Nauticus,* the battleships of the *Helgoland* class—*Helgoland, Ostfriesland, Thüringen* and *Oldenburg*—have a displacement of 22,800 tons, and an armament of twelve 12.2-inch, fourteen 5.9-inch, and fourteen 3.4-inch guns. The main armament of these vessels had long been known, or accurately surmised, but 6.7-inch had generally been assigned to the secondary battery. At one time there were, too, sketches in certain English papers, purporting to be drawn from visual evidence, showing four triple turrets. The guns, however, are arranged in the same manner as those of the *Nassau.*

The cruisers *Moltke* and *Goeben* are stated to displace 23,000 tons and to have a designed speed of 25.5 knots with 50,000 horse-power turbines. The armament is given as ten 11-inch, twelve 5.9-inch and twelve 3.4-inch, the arrangement being generally the same as in the *Von der Tann,* with an additional turret superposed forward of the aftermost. The disposition is thus almost identical with that in the *Hercules* and *Colossus,* six guns bearing ahead, eight astern, and ten on either beam.

Assuming the weight of the German 12.2-inch shell to be 981 pounds, of the 5.9-inch 112 pounds, and of the British 13.5-inch 1250 pounds, the following is the comparison between the *Colossus, Orion* and *Helgoland:*

	Colossus.		Orion.		Helgoland.	
	Guns.	Wt. of Fire.	Guns.	Wt. of Fire.	Guns.	Wt. of Fire.
		lbs.		lbs.		lbs.
Ahead.....	vi. 12-in.	5,100	iv. 13.5-in.	5,000	vi. 12.2-in.	5,886
Astern ...	viii. 12-in.	6,800	iv. 13.5-in.	5,000	vi. 12.2-in.	5,886
Broadside.	x. 12-in.	8,500	x. 13.5-in.	12,500	viii. 12.2-in.	7,848
All guns*.	x. 12-in. xvi. 4-in.	8,996	x. 13.5-in. xxiv. 4.0-in.	13,244	xii. 12.2-in. xiv. 5.9 in. xiv. 3.4-in.	13,676

* NOTE.—The number of 4-inch guns in the *Orion* is not certain.

For the corresponding battle-cruisers *Indefatigable, Lion,* and *Moltke,* the comparison is as follows:

	Indefatigable.		Lion.		Moltke.	
	Guns.	Wt. of fire.	Guns.	Wt. of fire.	Guns.	Wt. of fire.
		lbs.		lbs.		lbs.
Ahead.....	vi. 12-in.	5,100	iv. 13.5-in.	5,000	vi. 11.0-in.	4,560
Astern.....	vi. 12-in.	5,100	ii. 13.5-in.	2,500	viii. 11.0-in.	6,080
Broadside..	viii. 12-in.	6,800	viii. 12.5-in.	10,000	x. 11.0-in.	7,600
All guns*.....	viii. 12-in. xvi. 4-in.	7,296	viii. 13.5-in. xxiv. 4.0-in.	10,744	x. 11.0-in. xii. 5.9-in. xii. 3.4-in.	9,232

* NOTE.—The number of 4-inch guns in the *Lion* is not certain.

—*United Service Magazine.*

NEW TORPEDO NET EQUIPMENT.—Berlin, October 7.—There is every reason to believe that the prejudice with which German naval men originally viewed the reintroduction of torpedo nets has been overcome to a great extent by the many qualities of the new apparatus. The nets are operated by an auxiliary engine more rapidly, it is said, than is possible by manual labor. Great strength is a feature of the material, which offers a stout resistance to any kind of cutting appliance. The net hangs in a double fold, being kept in place by an entirely new type of boom, so arranged as to keep the net in proper position even when the vessel is steaming at a fair rate. All technical details of this inovation are still a secret, but it is known to be giving complete satisfaction. The reappearance of net defence in German ships shows that the authorities have at length come to recognize that other Powers are paying great attention to the development of the torpedo as a weapon of offence. Hitherto there was reason to suppose that the Marine Office looked upon the torpedo as its own special possession, to be exploited to its utmost capacity as a means of cheaply reducing the battleship strength of an enemy superior in numbers. One heard constantly of "the bolt from the blue," in the shape of an audacious torpedo attack on some great base of the unsuspecting foe, a plan which presupposed no very great watchfulness on the part of the latter. At the same time, little was done to give German battleships themselves any protection against this form of assault, seemingly because it was thought they had nothing of the kind to fear. That Great Britain and France both had a huge flotilla of surface and submarine torpedo vessels which, it might be assumed, had not been built to rust in dockyards, was a circumstance of no importance. It looks as though saner councils have prevailed, however, as is demonstrated by the new net equipment. No doubt the ever increasing chances of the successful employment of torpedos by "capital ships" against "capital ships" were taken into consideration. Much that has been published on the torpedo armament of new German armored ships is open to question, but is is quite clear that progress has been made in this as in other branches.—*Naval and Military Record.*

THE FORTNIGHT IN GERMANY.—*Summary:* Grand maneuvers and naval review at Kiel. Promotion of admirals and conferring of honary distinctions. Trial trip of the armored cruiser *Moltke;* its characteristics. Order for the construction of the armored cruiser *K.* Views on the speech of M. Delcassé, French Minister of Marine. Berlin, August 15, 1911. The autumn maneuvers of the German fleet, which sailed on the twenty-eighth of August, began with exercises in the waters lying between the Bay of Kiel, the island of Fehmern, the east coast of Holstein and the southern coast of the Danish Islands. "The imposing spectacle of the departure of our fleet," says the *Localanzeiger,* the official organ of the government, "showed that we possess today a sea force that has no cause to fear an encounter in the open sea. The time has passed when our naval inferiority compelled us to adopt a conservative policy inconsistent with the dignity of a great power."

The naval review in the Bay of Kiel, which on Tuesday, September 5, concluded the maneuvers, was a brilliant justification of these proud words. On the morning of the 5th, the weather threatened to be unfavorable to the imposing spectacle to be enacted in the Bay of Kiel. The sun lay hidden behind dark gray clouds and a fine rain was falling so persistently that the worst might be expected. At nine o'clock, the Imperial yacht, *Hohenzollern,* with the Emperor, the Archduke Francis Ferdinand, and a brilliant retinu of German princes and German and Austrian admirals on board, got under way. At the same time the weather began to clear, when about ten o'clock the *Hohenzollern* reached the fleet, the sun shone down on the magnificent spectacle from a blue sky. The fleet came slowly into the gulf preceded by six flotillas comprising sixty-six modern destroyers. The squadron followed in column, led by the flag-

ship *Deutschland,* flying the flag of the commander-in-chief. Simultaneously with the flagship, battleships and cruisers saluted the Emperor with thirty-three guns. The fleet was shrouded with a thick, white smoke furroughed by jets of yellow-red fire. The smoke cleared and then came the great moment. The endless line of battleships filed majestically by the supreme chief of the fleet. First came the *Deutschland,* then the four *Nassaus,* nine cruisers of the *Schlesien* and *Braunschweig* class, the four armored cruisers, *Blücher, Von der Tann, Yorch* and *Roon,* four battleships of the *Kaiser* class, and the cruisers *Worth, Brandenburg* and *Schwaben.* Eight protected cruisers, all provided with turbines, the tenders *Blitz* and *Pfeil,* the division of mine sweepers, and the flotilla of submarines brought up the rear. All the ships were flying the German battle flag, and the Austrian colors in honor of the Archduke Francis Ferdinand. Of course, the all important fact of the naval review consists in the appearance of the first German squadron of *Dreadnoughts,* although the squadron cannot be considered complete without the super-*Dreadnoughts Thüringen, Ostfriesland* and *Helgoland,* which have not yet completed their trial trips. After the ships had filed past, the Emperor and Archduke, accompanied by the Austrian Admiral, Count de Montecucoli, went on board the *Deutschland.* The whole fleet then put out to sea where it maneuvered for several hours before the Emperor and his hosts. These maneuvers consisted in a series of tactical drills and a long battle drill between a squadron composed of seventeen of the most modern ships and an enemy represented by the reserve squadron and the armored cruisers. Breakfast was served by the commander of the fleet on board the *Deutschland* while the fleet was making for its rendezvous near the island of Fehmern. The Archduke and Count Contecucoh must have been enthusiastic over what they witnessed. After having passed the afternoon on board the *Hohenzollern,* the Emperor and his hosts went on board the *Deutschland* about seven o'clock in the evening. After the dinner, the *Deutschland* returned to Kiel. On the way a night combat took place, with an attack by the destroyer flotillas. The scene was one of wild and savage beauty. The Emperor's guests beheld spellbound the luminous cones of the projectors, the thick clouds of powder smoke, the signal rockets, the dark, roaring water, the outlines of the great ships and the black-painted destroyers, while their ears were deafened by the incessant firing of the guns.

After passing the night on board the *Hohenzollern* the royal party left Kiel on the 6th of September for Berlin and Vienna, respectively. On the same day, the second part of the naval maneuvers was begun by a strategic operation extending as far as Skager Rack and Cattegat. The High Sea Fleet engaged a hostile force superior in number of units, which had as a neucleus the reserve squadron.

After the naval review the following were appointed vice-admirals: Rear-Admirals Bachmann and Von Krosigk; and rear-admirals, Captains Trummler and Stahmer.

The German Emperor has conferred the "Aigle Noir" upon the Austrian admiral, Count de Montecucoli; in return, the German admirals have been decorated with high Austrian orders.

After the naval review, the representatives of the German press were invited by the Navy Department to visit the *Oldenburg,* the latest type of German battleship. The foreign journalists were not admitted on board.

The armored cruiser *Moltke* has left the Blohm & Voss ship yards of Hamburg for Kiel where it began its trial trip flying the battleflag. The *Moltke* is the fourth *Dreadnought* put in service in the space of three months. The *Moltke* and the three battleships of the *Ostfriesland* class have a combined displacement of about 100,000 tons. The *Moltke* represents a considerable advance over the *Von der Tann,* having a displacement of 23,000 tons as against 19,000. The *Moltke,* like the *Von der Tann* has boilers of the Marinekessel type, with small tubes (the *Von der Tann*

has 18; the *Moltke* 24). The speed recorded officially as 25.5 knots, will probably reach 28 knots, as in the case of the *Von der Tann.* The armament comprises ten 28-mm. guns, twelve 150-mm. guns, and twelve 88-mm. guns. With a length of 186 m., the *Moltke* is the longest German warship, being 20 m. longer than the *Ostfriesland,* and 15 m. longer than the *Von der Tann.*

The contract for building the armored cruiser *K* has already been let to the Blohm & Voss shipyards of Hamburg, which have already built the *Von der Tann* and the *Moltke,* and are at present at work on the *Goeben* and the *H.* All the German *Dreadnought* cruisers have been entrusted to this firm which has established a world-wide record (28 knots, 12) for large ships.

The German press is vigorously attacking M. Delcassé, Minister of the French Navy, for having expressed at Toulon, at a time when the Moroccan conference is going on, his extreme satisfaction that the French equipment for war was ready to meet any emergency. "M. Delcassé has not always had," says the *Frankfort Gazette,* "that tact which makes the perfect statesman. It is quite natural that the Minister of Marine should praise his fleet. President Fallières had done this at Toulon some days before; this statesman, however, had been satisfied to speak of the future, while M. Delcassé clearly alluded to the present situation. If we may believe the articles published by M. Ludovic Naudeau in the *Journal,* the results of the first part of the French naval maneuvers were not so brilliant as to justify the superfluous praise of M. Delcassé."—*La Vie Maritime.*

The building program provides this year for the construction of three battleships, one large cruiser, two small cruisers, and twelve destroyers.

The battleship *S,* the large cruisers *K,* the small cruiser *Ersatz-Geier* comprising numbers 7 to 12 of the *G* class, will have Parsons turbines of 281,000 horse-power, representing 58 per cent of the marine engines built this year in Germany. Practically all of the 42 remaining per cent will be turbines allowing the rotary drum which is a feature of the Parsons turbine. Only six destroyers will have the multiple-disk rotors, and it is probable that the number of these disks will be reduced to three.

The change of opinion in Germany as to the efficiency of multiple-disk turbines may be attributed to the numerous accidents that have happened to purely actionary turbines.

The battleship *Thüringen* attained in its trial trip 21 knots, with normal displacement. The *Helgoland* completed successfully in August its preliminary trial trip. It was equipped on the twenty-third of August for its final trial trip. The small cruiser *Cöln* made 26.3 knots, in its trial trip. The battleship *Ersatz-Kurfürst Friedrich Wilhelm* will be built at Hamburg.

The cruiser *Moltke,* which has just completed its trial trip, attained a speed of 29½ knots, thanks to its Parsons turbines. It is a sister ship of the *Von der Tann.* It was launched last year after twenty-nine months had been spent in its construction.

The following is the program for the fleet (construction and armament of new ships) for the half year beginning October, 1911, and ending April, 1912:

1. Ships to be completed by the first of next April: the battleship *Oldenburg,* the cruiser *Goeben,* and the small cruiser *Breslau.* These ships will have made their trial trip by that date.

2. Completion of the cruisers *Kaiser* and *Friedrich der Grosse* and the second-class cruisers *Magdeburg* and *Strassburg.*

3. Continuation of the work on the battleships *Ersatz-Ægir, Ersatz-Odin* and *Ersatz-Hagen,* and the Cruiser *J.*

4. Laying the keels of the cruiser *S* and the battleships that are to replace the *Kurfürst-Wilhelm* and the *Weissenburg;* of the cruiser *K,* two small cruisers and an indefinite number of torpedo boats and submarines.

According to the *Ueberall* the contract for the construction of the two battleships *Ersatz-Kurfürst Friedrich Wilhelm* and *Ersatz-Weissenburg*, included in the program for this year, will not be issued for some weeks. The contract is to be let to a private firm since the arsenal at Wilhelmshaven has already a battleship on the stocks, and the one at Kiel is finishing the *Kaiser* after launching. The third battleship included in the program for 1911 has already been ordered. The armored cruiser *K* will be built by a private firm. It has not been decided where the small cruiser *Ersatz-Geier* will be built.

Contracts for the construction of the *Ersatz-Kurfürst Friedrich Wilhelm*, the *Ersatz-Weissenburg* and the fast cruiser *K* will be let out to private firms before a few weeks.

The small cruiser *Ersatz-Condor*, which was put on the stocks last summer, was launched at the arsenal of Wilhelmshaven on the 24th of August. This ship, which has a displacement of about 5000 tons, has been named *Strassburg*. The destroyer *G 194*, built by the shipyard Germania at Kiel, attained a speed of 36 knots.

The old battleships will be used for coast-defence purposes. To this end, an experiment will be made with two battleships of the *Siegfried* class. They are to receive each two 28 centimeter, 40 caliber guns; their hulls are to be made unsinkable. If this experiment is successful, it will be applied to the two *Brandenburgs*. The armor-plating of the two *Siegfrieds* will be replaced by the latest model Krupp steel plates. A similar attempt is being made in England to utilize the *Royal Sovereigns*.

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Orion	22,500	Portsmouth.	Under trial.
Monarch	22,500	Armstrong.	Launched Mar. 30, 1911.
Conqueror	22,500	Beardmore.	" May 1, 1911.
Thunderer	22,500	London (Thames Iron Works).	" Feb. 1, 1911.
Ajax	23,500	Scotts (Greenock).	Building.
Audacious	23,500	Cammell, Laird & Co.	"
Centurion	23,500	Devonport.	Launched Nov. 18. 1911.
King George V	23,500	Portsmouth.	" Oct. 9, 1911.
1	27,00?	"	Authorized.
2		Devonport.	"
3			"
4			"
Armored Cruisers.			
Lion	26,350	Devonport.	Under trial.
Princess Royal	26,350	Vickers.	Launched Apr. 29, 1911.
Australia	18,800	Brown & Co.	" Oct. 25, 1911.
New Zealand	18,800	Fairfield.	" July 1, 1911.
Queen Mary	26,850	Palmer (Jarrow).	Building.
1			Authorized.
Cruisers.			
Active	3,400	Pembroke.	Under trial.
Amphion	3,400	"	Building.
Weymouth	5,250	Armstrong.	Under trial.
Yarmouth	5,250	London & Glasgow Co.	" "
Southampton	5,400	Brown & Co.	Building.
Dublin	5,400	Beardmore.	"
Sydney	5,400	London & Glasgow Co.	"
Chatham	5,400	Chatham.	Launched Nov. 9, 1911.
Melbourne	5,400	Cammell, Laird & Co.	Building.

THE ORION'S GUNNERY TRIALS.—One of the most crucial tests in the gunnery trials of the new battleship *Orion,* with her 13.5-inch armament, was that of the "blast" test. The ship appears to have emerged from this test with no more damage to her hull and fittings surrounding the muzzles of the large guns, in their arc of fire, than could have been expected, considering she is the first ship of her type to be armed with the 13.5-inch gun of modern pattern. The charges of the old 13.5 weapon were much less powerful and the blast, therefore, much less destructive, than the 12-inch guns that succeeded them; but it was necessary in both cases, in the earlier type of battleship, to fit what is known as a "flash plate" across the sweep of deck over which the muzzle of the guns passed from any point at which they could be fired, in travelling from one broadside to the other. At the *Orion* trials the bottom of a boat was blown out by the blast, but that is not at all exceptional in a new ship firing her guns for the first time; indeed it is by such experience, showing which line the released gases are likely to take, that the ill-effects of the blast can be reduced to a minimum. Taken altogether, the authorities appear to have largely anticipated the safeguards which would be required, and have successfully placed them in position.—*United Service Gazette.*

THE BATTLESHIP ORION.—The center-line system of mounting the guns has been adopted for the *Orion,* owing to the increased weight and power of the new weapons. Any other arrangement would have subjected the ship to great strains, necessitating an increased displacement. By the center-line system, so successfully exploited by the American designers, the maximum arc of fire for each turret is gained, but at the same time the ahead and astern fire is curtailed. In view of the declining importance of axial fire, this cannot be regarded as a drawback.

Two of the five turrets are mounted on the forecastle, the after one being raised to enable its guns, theoretically, to fire over the other. A third is situated amidships on the center-line aft of the superstructure carrying the single tripod mast and pair of funnels. This turret is on the same level as the upper deck, and the superstructure, both forward and aft of it, has been carefully cut away in order to give the widest possible arc of training, which must be at least 120 degrees on either beam. Further aft is a raised superstructure carrying some of the 4-inch guns of the anti-torpedo armament, a pair of boat hoists, and a second conning tower. The two remaining turrets are superimposed, the higher being on a level with the bow turret, and having a very wide arc of training indeed. Although in theory two of the turrets can fire over those below them, it is extremely unlikely whether they will ever do so in practice, even in the case of the lighter 12-inch turrets of the *Neptunes.* During the gun trials of the *Minas Geraes* and the *Neptune,* it is found that living organisms would not suffer to any great extent from the blast of such firing, but it is very doubtful if they would be equally unaffected by the far heavier discharge of the new battle gun. Consequently it is misleading to regard the ahead or astern fire of the *Orion* as more than two guns, and the number does not increase to four until the target is some degrees to one side of the axial line of the ship. If there are no grounds for this assumption, it is difficult in the design of the new cruiser *Lion* to account for the turret which is placed between the second and third funnel not having been superimposed above the stern turret so as to swell the astern fire. Without gaining increased axial fire astern, the system of superimposed turrets does give some advantages. Turrets so mounted do not take up so much of the length of a ship as would the same turrets if mounted on exactly the same level, as in the American vessels of the *Utah* and *Delaware* classes. Again, the training of such turrets is only curtailed by considerations of blast, and they can be safely trained over small additional arcs which would be impossible in the cramped American system owing to the interference of the adjacent turret. Another con-

sideration is the possibility of the jamming or disablement of the stern turret, when, without the superposed guns the stern fire would be greatly curtailed.

There is very little in the disposition of the main armament which can be criticised adversely. It is a great improvement on the two systems of mounting ten guns which has hitherto been adopted in British *Dreadnoughts,* and is superior to that adopted in the four American examples above quoted, in which two of the turrets are rather cramped.

With regard to the total weight of broadside, the following table shows the great superiority of the *Orion* over all foreign ships of the same program (1909-10) in this respect:

Name.	Broadside.	Total weight (lbs.)
Oldenburg (Germany)	8 12.2-in.	7,848
Kaiser (Germany)	10 12.2-in	9,810
Arkansas (U. S. A.)	12 12-in. 50 cal.	10,404
Courbet (France)	10 12-in. 50 cal.	9,720
D. Alighieri (Italy)	12 12-in. 46 cal.	11,032
Cavour (Italy)	13 12-in. 46 cal.	11,951
Moreno (Argentine)	12 12-in. 50 cal.	10,404
Hercules (Great Britain)	10 12-in. 50 cal.	8,500
Lion (Great Britain)	8 13.5-in. 45 cal.	10,000
Orion (Great Britain)	10 13.5-in. 45 cal.	12,500

The Italian vessels *Dante Alighieri* and the three *Cavours* are the only serious rivals in this respect, mainly through the number of guns mounted being twelve in one case and no less than thirteen in the three others, in spite of their displacement being no more than 21,500 tons. The British Admiralty ever since the introduction of the *Dreadnought* has steadfastly set its face against armament of more than ten guns, with the result that the *Hercules,* the last of the British 12-inch gun ships, makes a poor showing in the above table in comparison with the *Arkansas, Dante Alighieri, Cavour, Moreno,* and also the older Brazilian *Minas Geraes.* Hence the introduction of the 13.5-inch was very welcome, in view of the official adherence to a ten-gun armament. However, foreign nations have not been slow to follow the British lead, and in the program of 1910-11 and 1911-12 provision has been made by the United States for four ships mounting a new 14-inch, and by Japan for four ships with 13.5-inch guns. Germany intends to mount 14-inch in some of her new ships, and France has a 13.4-inch weapon on the tapis. As the broadside of the new American ships amounts to about 14,000 pounds, it will be necessary to make further improvements in the main armament of the *Orion's* successors.

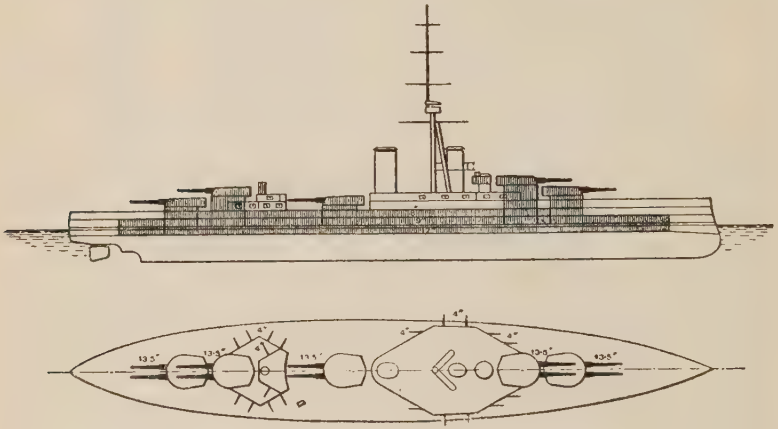
Unlike previous British *Dreadnoughts,* the armor protection is continued right up to the upper deck, and this upper strake extends from the forward turret to a point just aft of the fourth turret. The main belt is believed to be 12 inches thick, tapering to four inches at the ends, and is not quite complete, as it is considered sufficient to protect the extremities of the ship by minute subdivision into compartments. Owing to the fine lines of modern battleships and armored cruisers, the armored protection could at best be only a few inches thick, and would be quite useless for keeping out shells.

The machinery of the *Orion* was contsructed by the Wallsend Company, and consists of Parsons turbines of 27,000 horse-power, driving four screws, and giving the usual battleship speed of 21 knots. Eighteen Yarrow boilers arranged in three groups supply steam, and can be fired by oil fuel as well as coal. The total fuel supply is 3700 tons, including 1000 tons of oil, sufficient for a large radius of action.

In spite of the increased weight of the heavy armament and the great increase in length of the *Orion,* the jump in displacement has not been remarkable. The *Neptune,* with her ten 12-inch, has a displacement of

19,900 tons, and a length between perpendiculars of 510 feet; the *Orion* is heavier by 2780 tons, while her length is 545 feet between perpendiculars. Over all she measures no less than 584 feet, has a beam of 87 feet, and normally draws about 27½ feet.

In speed of construction the battleship *Orion*, although the first ship of a new type, bids fair to rival the *Vanguard*, which was commissioned within 23 months from the laying of her keel-plate. The *Orion* was laid down at Portsmouth on November 29, 1909, and having begun her trials on the 11th inst. will return to that port if all goes well on the 25th, which will leave more than five weeks to enable her to be commissioned within the period taken by the *Vanguard*. It is satisfactory to note what the position with regard to the construction of the new type will be in March, 1913, when the first foreign vessel mounting 14-inch weapons comes into commission. This ship is believed to be the *Ersatz Odin*, building at Kiel, although there is no definite information on the subject. When she joins the pennant Great Britain will possess a division of eight battleships,



OUTBOARD PROFILE AND DECK PLAN OF "ORION," SHOWING DISPOSITION OF GUNS AND ARMOR.

and in addition three armored cruisers all armed with 13.5-inch guns. By March, 1914, ten other ships will have been commissioned for Germany, Japan and the United States, while five more will join the British Navy, and so to this extent will Great Britain lead the world at that date.—*Military Record.*

The battleship *Orion* returned to Portsmouth Harbor on the 26th ult. on the completion of her gun trials, which, with all the other tests imposed upon her, are officially described as having resulted very satisfactorily. Four full charges were fired from each gun on extreme bearings. The whole ten 13.5-inch guns were also trained on a broadside and fired simultaneously. This caused the ship to heel over about three degrees, but did not damage the hull. When the two guns in the elevated barbette were fired four boats on the upper deck were broken up by concussion. The mountings of all guns, however, showed no signs of weakness. The *Orion* also successfully carried out her torpedo trials and will now prepare for the pennant. The result of the trials is of additional interest owing to the circumstance that she carries ten 13.5 guns and in view of the position of the guns in the ship and their mounting. The ship's structure withstood well the heavy strain thrown on it by discharge of the guns. The hull was examined at intervals during the progress of the

firing, but showed no sign of having suffered injury from concussion. As usual some breakage was caused amongst glass and lighter woodwork, but this is of no account.

H. M. BATTLESHIP KING GEORGE: AN IMPROVED ORION.—Nothing official concerning the battleship *King George V.* has been, or will be obtainable, but from what is known, says the *Times,* the following particulars will be found substantially correct.

It is understood that in all essential details, such as the gun power and the number and position of the guns in the ship, the arrangements in the *King George V.* will be similar to those in the Orion. The new vessel will, however, be 15 feet longer, with 6 inches more beam, and will displace about 1500 more tons than her predecessors, as it is believed that the length of the *King George V.* is 555 feet between the perpendiculars, 596 feet over all, with a beam of 89 feet, and that her displacement when completed will be about 24,000 tons, her launching weight being approximately 9000 tons. The machinery is to be of the Parsons steam turbine type, working four shafts and four propellers, capable of developing a shaft power of 31,000 horse power, giving a speed of 21 knots. The steam is to be furnished from 18 water-tube boilers. The main armament will consist of ten 13.5-inch guns disposed in five turrets being placed in the center-line of the ship, and giving a broadside fire of 10 guns, and ahead and astern a fire of four, the second and fourth turrets being raised to enable the guns to fire over the first and fifth. The secondary armament for repelling torpedo attacks will be the latest type of 4-inch guns, which will be mounted under armor, the increased weight of the vessel enabling better protection to be given.

The *King George V.* will have one mast, and three submerged torpedo tubes for firing the 21-inch torpedo. The officers will be berthed in the after part of the ship and the men in the forward part, as it has now been found that this arrangement answers best. In consequence of this reversion the vessel is fitted with an Admiral's stern walk, which no battleships built in recent years have carried.—*Naval and Military Record.*

BRITAIN'S TWENTY-FIRST DREADNOUGHT.—The battleship *King George V.* was the first vessel of the 1910-11 program to take the water. She is the twenty-first British *Dreadnought,* and the seventh ship designed to carry the 13.5-inch gun. In all essential particulars she is similar in design to the *Orion,* whose trials have just been successfully completed, but is about twenty feet longer and over one thousand tons heavier in displacement. Like the *Orion,* the *King George* will carry ten 13.5-inch guns and about 20 4-inch as the anti-torpedo armament. The heavy guns will be in five double turrets mounted on the center line of the ship, the aftermost fore turret and the foremost after turret being raised above the others. The *King George V.* is the second ship in the navy to bear the name of a reigning sovereign. She belongs to the first program of King George's reign, as the *King Edward VII.* belonged to the first program of King Edward's reign, and a comparison of the two gives a fair idea of the evolution of the "capital ship" since 1902, when the *King Edward* was laid down at Devonport Dockyard.

	King Edward VII.	King George V.
Displacement	16,350 tons	24,000 tons
Length	454 ft.	596 ft.
Beam	78 ft.	89 ft.
Complement	777	900
Speed	18½ knots.	21 knots
Guns	4 12-in.: 4 9.2-in.: 10 6-in.	10 13.5-in.
Weight of broadside	4,660 lbs.	12,500 lbs.
Armor	9-in. belt.	12-in. belt
Torpedoes	18-in.	21 in.

—*Naval and Military Record.*

OUR NEXT BATTLESHIPS.—The Admiralty, says *Engineering,* has invited private firms to submit tenders by the end of the month in connection with the construction of four battleships. Two of these battleships with their machinery, will be built in private works, and prices are asked for hull and machinery, while two will be constructed respectively at the Portsmouth and Devonport dockyards, and engineering firms are asked to submit prices for the construction of the Parsons turbine machinery and the Babcock or Yarrow watertube boilers for these. One more armored ship is included in the navy program for the current year, and this will be a cruiser of the *Lion* type, to be built by contract, and to complete a cruiser fleet unit of four such vessels of 28-knot speed with practically the fighting power of battleships. The other three vessels are, of course, the *Lion,* the *Princess Royal,* and the *Queen Mary.* The new battleships will resemble the four ships of the *King George V.* class, which are to be launched within the next three or four months. The differences in the new battleships are unimportant, though it is probable that an advance will be made in connection with the torpedo-repelling guns. There will be a slight increase in displacement to over 24,000 tons, and the horse-power will be increased to 29,000 in order that the same speed of 21 knots may be easily realized.

A Glasgow correspondent says: Private builders are also tendering for seven special destroyers of exceptionally high speed. The tenders for three protected cruisers were sent in to the Admiralty on Wednesday.

The four battleships (says the London correspondent of *The Glasgow Herald,* are as a matter of course to be bigger than their immediate predecessors—how much bigger it would not be fair either to the Admiralty or their contractors at this early stage to say. Like every other type of warship, battleships have a sort of natural tendency to grow, although the effect on offensive or defensive quality is not always visible to, so to say, the naked eye. The *Bellerophons* displace 700 tons more than the *Dreadnought,* but they carry sixteen 4-inch guns instead of her twenty-seven 12-pounders. The *St. Vincents* displace 650 tons more than the *Bellerophons,* yet have only to the eye of the observer four 4-inch guns more. The *Neptunes* displace 750 tons more than the *St. Vincents,* and on the bigger dimensions are able to give a broadside of ten 12-inch guns without any apparent sacrifice in ahead or astern fire. The jump from the *Neptunes* to the *Orions* is 2250 tons, and for that we get at any rate the middle line arrangement and increase of an inch and a half in the caliber of the main guns. As I indicated on Tuesday, we get in the *King Georges* a better and better protected anti-torpedo armament for the additional 2500 tons. Of course there have been other improvements costing weight, but only striking features like those which I have indicated as a rule interest the public. For the greater displacement of the projected ships I assume we shall get 4.7-inch guns, and as a matter of course better 13.5-inch guns. The displacement is in the region of 27,000 tons.—*Naval and Military Record.*

Laid down on February 19 of last year, at the works of Vickers & Co., Barrow, the new protected cruiser *Dartmouth* of the improved town class, built and equipped at an estimated cost of £334,847, yesterday carried out her eight hours' acceptance trial preparatory to her delivery to the Admiralty. The *Dartmouth* is the second cruiser of her type to be completed for sea, the first, the *Falmouth,* having recently joined the Second Battle Squadron as an attached ship. The *Dartmouth* has a length of 430 feet, a breadth of 48 feet 6 inches, and a displacement of 5250 tons, while her turbines are of 22,000 horse-power, and capable of propelling her at a speed of 24.75 knots. Her armament consists of eight 6-inch breech loading guns.—*United Service Gazette.*

The construction of the second-class protected cruiser *Chatham,* building at Chatham Dockyard, is so far advanced that the contractors for the

engines, the Thames Iron Works Company, have commenced to make the preparation on board for putting in certain parts of the machinery before the vessel leaves the slipway. The ceremony of launching the *Chatham* is expected to take place early in November. There has been no public launch at Chatham since the battleship *Africa* was set afloat, more than six years ago.—*United Service Gazette.*

Owing to a variety of causes the armored cruiser *Lion*, the first of the class to be fitted with 13.5-inch guns, is not up to program time. The *Lion* was laid down at Devonport Dockyard on November 29, 1909, and it was expected that she would have been ready by the end of September or the early part of October to commence her steam trials, which are being looked forward to with unusual interest owing to the machinery being designed for 70,000 shaft horse-power. The contracting engineers have been hampered by labor trouble, and it has now been found desirable to disconnect the whole of the shafting to re-test its accuracy owing to one portion being slightly out of alignment. The dockyard portion of the work is also in arrear owing, it is stated, to the *Lion* embodying several new features. Instead of the cruiser being ready for service in two years from the laying down of the keel, there is now no prospect that she will take her place in the fleet before the latter part of January at the earliest. —*United Service Gazette.*

The new protected cruiser *Falmouth*, laid down on February 21, 1910, at the works of Messrs. W. Beardmore & Co., of Dalmuir, has been reported ready for delivery from the builders as completed for commissioning. The *Falmouth* is the first of the improved *Bristol* class of cruisers, and has been constructed with a length of 430 feet, and a displacement of 5250 tons, being 450 tons larger in displacement than the cruisers of the *Bristol* class. Her armament is also of a more powerful type, consisting of eight 6-inch breech-loading guns, compared with two 6-inch and ten 4-inch guns mounted in the earlier cruisers. Her estimated cost is £339,274.

STEAM TRIALS OF H. M. S. SANDFLY.—The torpedo-boat destroyer *Sandfly*, built for the British Navy by Messrs. Swan, Hunter and Wigham Richardson, Limited, Newcastle-on-Tyne, and fitted with her machinery by the Wallsend Slipway and Engineering Company, Limited, Wallsend-on-Tyne, completed on Monday, the 23d of October, her official eight hours' steam trials, when she attained a speed of 27.7 knots with the turbines running at a mean of 741 revolutions and developing 15,700 shaft horse-power. The designed speed was 27 knots. On her 24 hours' fuel consumption trial on the preceding Wednesday the oil used was about 1 pound per shaft horse-power per hour. The *Sandfly* is 240 ft. long, 25 feet 9 inches beam, and at 7 feet 10 inches draft displaces 780 tons. She is armed with two 4-inch quick-firing and two 12-pounder guns.

The fleet coaled again on Monday. The coaling was only a small one, but was very well executed. The *Duncan* and *Triumph*, as usual, tried to out-vie each other with their well known coaling feats. On this occasion they were fairly close, the *Duncan* leading. The *Swiftsure* was a very good third. These short coalings are very strenuous, and it is amusing to see the craft and subtlety adopted to prevent any loss of "time."

Results:

	Amount.	Average per hour.
1. Duncan	670	423.2
2. Triumph	530	413
3. Swiftsure	580	386.8
4. Bacchante	535	321
5. Exmouth	500	309.3
6. Russell	665	249.3

—*Naval and Military Record.*

H. M. S. *Archer*, the first of five destroyers of special type under construction for the British Admiralty at the works of Messrs. Yarrow & Company, of Glasgow, was launched on Saturday the 21st inst. The vessel is 240 feet long by 25 feet 7 inches beam, propelled by twin screws driven by turbines of the Brown-Curtis type constructed by Messrs. Yarrow. Steam is supplied by three Yarrow water-tube boilers fired by oil fuel and fitted with a special form of superheater designed by the firm.

BRITISH BATTLESHIP BUILDING PROGRAM.—The only lesson which the unfortunate outbreak of war between Italy and Turkey has, so far, taught, or appears likely to teach, is the need of complete preparedness for war at all times, since once more it has been demonstrated that the "bolt from the blue" is not the mere imagery of the poet. As with Japan, so with Italy, the issue of the ultimatum, or declaration of war, was instantly followed by military operations. Although such action may not of itself ensure in all cases ultimate success, it confers a considerable advantage in the initial stage, which may influence greatly the final issue. It is therefore gratifying to note the unequivocal pronouncement of the First Lord of the Admiralty in reference to our building program, which is an important item in any scheme of preparedness for war. Like every other citizen, he is anxious for the minimising of naval expenditure as far as prudence permits, but he has once more laid down the dictum that our program must be determined with full conception of the effect in war strength, at any future date, of the building operations of possible combatants. Thus he naturally awaits the issue of the estimates of foreign powers before completing the preparation of his financial and shipbuilding proposals for next year.

In the meantime it is agreeable to record simultaneously the satisfactory completion of the searching trials of the first of our ships fitted with the 13.5-inch gun, the prospective launch within the next three months of of our new battleships, the issue of orders to Portsmouth and Devonport dockyards each to prepare for the building of a battleship, and the sending of invitations to private firms to tender for the building of two battleships included in the current year's program. In addition to these four battleships closely resembling the four ships of the *King George V.* class, soon to be launched, there will be a fifth armored ship. This will be a cruiser of the *Lion* type, and will also be built by contract. This vessel will complete a cruiser fleet unit of four ships of 28 knots speed, with practically the fighting power of battleships. The differences in the new battleships, as compared with *King George V.* class, are unimportant, although it is probable that an advance will be made in connection with the torpedo-repelling guns. There will be a slight increase in displacement to over 24,000 tons, and the horse-power will be increased to 29,000 shaft horse-power in order that the same speed of 21 knots may be easily realized. More it might not be patriotic to divulge at the present moment, and we depart from the remark that the Admiralty obviously intend to place the orders for the three contract armored ships, and for the machinery for the two ships to be built in the dockyards, before the end of the year, since the tenders for battleship work are to be at the Admiralty by the 31st of the present month.

The *King George V.* is to be launched on Monday from the Portsmouth Dockyard, the *Centurion* from the Devonport Dockyard a month later, and in December the Scotts' Shipbuilding and Engineering Company will launch the *Ajax*, and Messrs. Cammell, Laird & Co. the *Audacious*. All four ships are in a satisfactorily advanced stage, so that notwithstanding the labor troubles, they are likely to be completed in two years from the date of laying the keel; but it is probable that they will not be ready for commission before the beginning of 1913. These ships are a development of the *Orion* class. It seems almost inevitable that the demands of the strategist and tactician should, in the case of each successive ship, involve increased displacement.

The machinery, as in all of the later battleships, is of the Parsons type, and the constructors were the Wallsend Slipway and Engineering Company. The two low-pressure turbines are in one center engine-room, and the low-pressure astern turbines are incorporated in the same casing as the ahead turbines. Each wing-shaft has a separate high-pressure ahead and astern turbine, the ahead turbines being arranged with cruising blading, to be cut out when the vessel is running at high speed; a by-pass valve is fitted for this purpose. The boilers are of the Babcock and Wilcox type, fitted to burn coal and oil, and, as in the usual Admiralty practice, quite 2 square feet of heating surface is allowed for each horse-power to be developed, the ratio of heating to grate surface being 35 to 1. The condensers are of Weir's "Uniflux" type, with Weir's dual-type pumps. On the trials, which were attended by Mr. Andrew Laing, the managing director of the contracting company, and by Engineer-Captain Onyon, on behalf of the Engineer-in-Chief, the results were in excess of those anticipated in the designs. Trials were run at progressive speeds, in order to determine the radius of action at given speeds. The principal trial was that of 30 hours duration at two-thirds power (18,500). On this trial the mean revolutions of the turbines were 298, and the horse-power developed 18,960, the fuel consumption being 1.8 pound per shaft horse-power per hour. During this trial six runs were made over the measured distance at Polperro, when the speed was found to be 19.5 knots with the engines developing 18,900 shaft horse-power. On the eight hours' full power trial the mean revolutions were 346, and the shaft horse-power 27,600, the four runs giving a mean speed of 21.02 knots, with the engines developing 27,400 shaft horse-power. At full power the fuel consumption was equal to 1.62 pounds of coal per shaft horse-power per hour. In a subsequent trial, with the engines more fully opened up, 29,700 shaft horse-power was maintained. It will thus be seen that the 21 knots anticipated in the design were realized, and that, in emergency, even a greater speed can be got out of the machinery.—*Engineering.*

An admiralty order received at Pembroke Dockyard directs the authorities to commence building a new unarmored cruiser, for which initial provision was made in the Navy Estimates for the current financial year. The new ship will be a replica of the *Active* and the *Amphion,* now being constructed at Pembroke Dockyard. Her length will be 385 feet, and her displacement 3360 tons. She will be equipped with Parsons-Curtis turbines of 18,000 horse-power, and will steam 25 knots per hour. A sum of £11,200 will be spent in labor on her during the year.—*United Service Gazette.*

NEW DESTROYERS ORDERED.—Messrs. J. Samuel White & Co., of Cowes and East Cowes, have received an order for six ocean-going destroyers of a special type, larger than those generally adopted. At Sheerness on Monday the *Ferret,* ocean-going destroyer, built at Cowes for the British Navy by Messrs. White & Co., developed a speed of 30 knots on an eight hours' speed trial, or three knots in excess of her contract speed.—*Pages Weekly.*

NAVAL CONSTRUCTION.—There is a general agreement that the authorities have made a wise decision in selecting Sir William Smith as the successor to Sir Philip Watts. The new director of Naval Construction has not only a high reputation as a designer of ships, but he has done plenty of sound, solid work as an instructor of other naval architects at the Royal Naval College. His practical experience as a draftsman and constructor goes back a matter of forty years, and covers the period of the later ironclad vessels as well as those of the area of steel. More recently he has filled the post of superintendent of construction accounts and contract work, in which he has been brought closely in touch with the officials of the great private shipbuilding establishments. Here he won golden

opinions by his tact and good temper, just as his ability and industry had gained for him the commendation of his colleagues. Thus his appointment gives satisfaction in all quarters, and not the least to the Royal Corps of Naval Constructors, who are gratified that one of themselves should have been chosen instead of the post going outside the Admiralty, as at first appeared to be possible. No date appears to have been fixed for the departure of Sir Philip Watts, but when it comes there will be much regret at his leaving. His name will always be associated with the *Dreadnought* era, and with the many notable vessels to which it has given birth. It is quite possible, however, that during the next few years we may see another change, and that his successor may have the honor of designing the first gas-driven battleship for the British Navy.—*Army and Navy Gazette.*

THE COMING NAVAL OFFICERS.—To show how thorough the Admiralty intend the test of the general knowledge on all subjects to be, in the examination of the sub-lieutenants of the new system of training who are now passing for lieutenants, it is only necessary to select one of the subjects in which this knowledge will be tested. If we choose that of gunnery, as one only of the principal subjects, we find that the questions which have to be answered are very searching, for a candidate will be tested practically in almost every phase of up-to-date naval gunnery, and the ramifications of this science are rather more than considerable. He will be tested in adjusting, stripping and assembling hand-worked gun mountings, and he will have to describe the method of stripping and examining all the principal machinery of a 12-inch gun turret, and know all the probable causes of breakdowns and their remedies. He must have a thorough knowledge of all the leads and contacts of gun circuits, and know their tests and how to repair them, and also all the safety arrangements. A good knowledge of the sighting of all kinds of guns is required so as to be able to instruct a gun's crew or himself do the duties of a number at hand-loading and power worked guns, and he must be acquainted with the machinery and fittings of turrets. He must also know all about the projectiles, charges and fuses used with naval ordnance, and the methods of getting them on board and storing them in the magazines. He must have a knowledge of field training, and a thorough knowledge of hydraulics and how to organize a ship for war and battle; of fire control and night defence; of calibration and all sighting and controlling instruments, etc. It will thus be seen that if his training has been expensive it has also been extensive, and that he will be one of the best trained naval officers in the world if he reaches the standard expected of him.—*United Service Gazette.*

Throughout the navy it will be noticed with interest and appreciation that in approaching the consideration of the subject of a War Staff for the Navy Mr. Churchill called to his counsel the most experienced officers of the fleet. At his right hand he had Sir Authur Wilson, then within a few days of Mr. Churchill taking office, Lord Fisher had returned from Switzerland and conferred with the First Lord. A day or so later Lord Charles Beresford was very appropriately also called into counsel. Lord Charles has in recent years consistently urged the necessity of creating a staff for the navy, and it was apparent when the report of the Cabinet Committee was issued that Mr. Asquith and his colleagues had come to the conclusion that the Admiralty organization left something still to be desired in this direction. The members of the Cabinet seemed to believe that a Naval Staff would dissipate all differences of opinion between officers of high rank and professional attainment on questions of strategy, tactics and fleet organization. This is an erroneous conception of its duties. The last thing that is desirable is that any machinery shall be created which will interfere with the free exercise of thought and the healthy differences of opinion which make for progressive action. The

navy has certainly no desire to see any machinery invented which will compress its thought within narrow channels.

The end in view in establishing a Naval Staff is the better to fit the navy for quick and decisive use directly a state of war exists. Prior to the beginning of the present century such a staff would have found itself floundering in a hopeless morass. The active fleet at that time was still distributed on the principles laid down one hundred years before. The presence of half-manned and undrilled coast and port guardships testified to the survival of the coastal defence ideas which held sway at the beginning of the Victorian period, and practically there was no reserve organization of the fleet; the Board of Admiralty was under-manned and the Intelligence Department was largely dominated by the civilian element. Under Lord Walter Kerr, and more particularly as a result of the energetic reforms instituted by Lord Fisher, all this has been changed. The fleet is now distributed in accordance with the strategic needs of the moment. The bulk of the personnel is utilized in effective men-of-war: the Board of Admiralty has been immeasurably strengthened by the appointment of officers to assist the Sea Lords, and the Naval Intelligence Department has not only been strengthened, but has been relieved of the work of naval mobilization and the preparation of war plans, which it was supposed to carry out under the old régime. At the same time the Naval War College has been developed. The foundations have, in fact, thus been laid for the creation of a staff which shall be an extension of the mind of the First Sea Lord, a link with the growing navies of the oversea dominions, and a school of thought for the fleets at sea.—*Naval and Military Record.*

ITALY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Dante Alighieri	19,000	Gov't Yard, Castellamare.	Launched Aug. 20, 1910.
Cavour.	22,000	" " Spezia.	" Aug. 10, 1911.
Giulio Cesare	22,000	Ansaldo-Armstrong.	" Oct. 15, 1911.
Leonardo da Vinci ...	22,000	Genoa (Odero).	" Oct. 14, 1911.
Scouts.			
Quarto.....	3,400	Venice.	" Aug. 19, 1911.
Marsala	3,400	Castellamare.	Building.
Nino Bixio.....	3,400	"	"

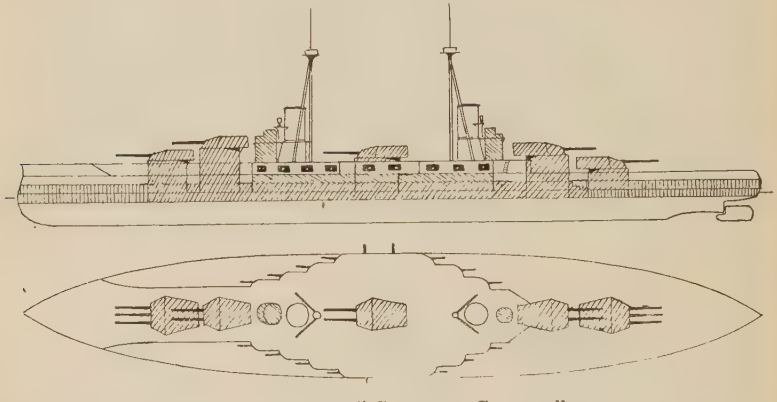
ITALIAN DREADNOUGHT "CONTE DI CAVOUR."—The *Conte di Cavour,* Italy's second *Dreadnought,* was launched at Spezia last August. In design she is quite the most unique of the many and varied types of battleship which come under this heading, and possesses the proud distinction of mounting the most numerous all-big-gun battery yet put into a modern warship, which consists of thirteen 12-inch guns.

As may be seen from the plan, these are carried in five turrets, of which two are raised to fire over the fore and aftermost and the remaining one is amidships between the masts. These three lower gun-houses carry three guns apiece, while the raised positions contain the ordinary twin-mounting. All can be trained on either beam, and five axially ahead or astern, giving her a fire concentration of 11,050 pounds per broadside and 4250 pounds in the latter directions. For comparative purposes we append a table showing the fire concentration and main details of her contemporaries.

The anti-torpedo battery is carried along the upper deck and consists of eighteen 4.7-inch guns, while a tertiary armament of fourteen 14-pounders is distributed over the superstructures and turret tops. These are not shown in the plan, as their exact positions are uncertain. A somewhat novel and original way of spacing the 4.7-inch guns has been adopted

in order to provide for a heavy end-on fire. The hull side is deeply recessed in a series of steps fore and aft of the two center 4.7-inch ports so as to provide accomodation for four guns forward and three aft per broadside.*

Turning again to the main armament, the actual battle-value of this huge collection of ordnance is a somewhat debatable point. As we have mentioned in preceding articles, the maximum number of guns that can be "controlled" from central range-finding stations is ten. What system is in use in the Italian navy is uncertain, but unless they have some such arrangement of the range-finders as is in vogue in Germany, *i. e.*, one to each turret, whereby the groups of guns would be under five individual controls, it is unlikely that the fullest use will be obtained with the best results from the thirteen guns.



PLAN OF THE "CONTE DI CAVOUR."

	Nation.	Displacement in tons.	Speed.	Armament.	Broadside. (Not including tertiary or 4" guns).	Axial.
					lbs.	lbs.
Orion	Great Britain	22,600	21	10 13.5" guns 16 4" "	12,500	5,000
Arkansas	U. S. A	26,000	20.5	12 12" " 21 5" "	10,800	3 640-3,700 astern
Jean Bart	France	23,000	20	12 12" " 22 5.5" "	10,426	8,156 8,320 astern
Veritus Unitis	Austria	20,000	21	12 12" " 12 6" " 18 smaller	12,749	8,157
Sao Paulo	Brazil	19,250	21	12 12" guns 22 4.7" "	10,695	7,080
Helgoland	Germany	22,800	20.5	2 12" " 14 5.9" " 14 3.4" "	8,478	6,240
Sevastopol	Russia	23,000	23	12 12" " 6 4.7" "	9,056	2,356
Moreno	Argentine	27,940	22.5	12 12" " 12 6" " 12 4" "	10,830	7 010 4,602
Conte di Cavour	Italy	21,500	22.5	13 12" " 18 4.7" "	11,402	4.558 astern

* Current plans incorrectly give her no forecastle deck, and these 4.7-inch carried in groups of four, one and four instead of four, two and three.

The three-gun turrets are now no longer a novelty, although it so happens that the *Cavour* is the first ship so fitted to be discussed in these columns. In any case they can only be regarded as a weight-saving but risky device employed *faute de mieux* in order to crowd in an increased number of smaller guns instead of substituting fewer guns of larger caliber. The *Cavour* could, and would, doubtless have been armed with ten 13.5-inch had these pieces been available in Italy, and for this reason her being fitted with thirteen 12-inch can only be looked upon as a temporary expedient to produce a more powerful ship than her neighbors, pending the introduction of the 13.5-inch, 14-inch or even 16-inch gun.

The armor protection is somewhat light for a ship of her size, but taken in conjunction with the armament and designed speed of 22.5 knots with 24,000 I. H. P., it is probably a good deal more extensive than could have been allotted to a similar ship built elsewhere. In our article on the *Napoli* (August, 1909), we mentioned in passing the Italian ability to get a better all-around ship on a given displacement than could be produced elsewhere. Where robustness is not the essential that it is to some nations, weight in scantlings, supports and frames can be reduced to what in our own ships would be probably below the minimum, added to which the wholesale use of asbestos fittings and hollow metal-work wherever possible, and you have a drastic saving in weight which can be utilized in other directions.

On paper the *Cavour* is, with the exception of our *Orions,* the most powerful ship afloat, added to which she has a higher designed speed than any battleship built or building, except the Russian *Poltava* class, and could therefore choose her own range in action, and maintain the best maneuvering positions. In practice her lack of displacement must tell somewhere or sometime; either in her ability to stand continuous firing, big-gun hammering, torpedo attack by below-water protection, or seaworthiness and speed-keeping in heavy weather. As she stands, however, the *Cavour* is a monument to Italian ingenuity in weight saving.

The thickness of the belt (water-line) is uncertain, but will doubtless be similar to that of the *Dante Alighieri* which preceded her, *i. e.,* 10 inches amidships with continuations 6 inches forward and 4 inches aft. The protective deck is 1¾-inch only. An 8¾-inch strake covers the lower deck side and forms a redoubt, while the battery is behind 5-inch armor. The big gun barbettes and turrets have 9¼-inch protection, and there are two 11-inch conning towers of a novel pattern. Details of these are lacking, but from the model of the ship they appear to be three-story structures and will probably contain the central gun-control stations. The tripod-masts will be a good deal lighter than those fitted to our ships and carry a small observation platform, wireless rig, etc.

It is also reported that the funnel-bases are to be armored, but no confirmation of this can be obtained. In view of their close proximity to the 4.7-inch battery guns, it is most likely that this necessary precaution will be taken against having the flats permeated with smoke and fumes from pierced uptakes.

The *Cavour* class will have their steam generated in Blechynden or Babcock boilers, and be turbine driven. Their coal supply is not likely to differ much from that of the *Dante Alighieri,* which is normal 1000 and maximum 2500 tons.

British pattern "Bullivant" torpedo-nets will be stowed along the battery deck.

Two sisters, the *Giulio Cesare* and *Leonardo da Vinci,* are building at the Odero and Orlando yards respectively, and all three ships are to be completed by 1913.—*The Marine Engineer and Naval Architect.*

The first of the Italian scouts, the *Quarto,* was launched on Saturday August 19, in the somewhat cramped space of Venice Arsenal. She was

laid down on November 11, 1909, and will be ready for sea in five months. Her designer, Ing. Truccone, has paid special attention to her internal strengthening, and has given her a double bottom for two thirds her length. She has ten Blechynden boilers and four Parsons' turbines developing 25,000 horse-power, and carries 450 tons of liquid fuel—her only fuel—and 200 blockade mines. Some of her principal dimensions are as follows: Length between perpendiculars, 130.50 m.; breadth, maximum, 12.80 m.; draft, 3.95 m.; speed, 28½ knots; armament: six guns—two bowchasers and four stern—of 120 mm.; six guns, 76 mm.; two torpedo tubes, 450 mm. —*Engineering.*

JAPAN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Aki	19,800	Kure.	Under trial.
Kawachi	20,800	Yokosuka.	Launched Oct. 15, 1910.
Settsu	20,800	Kure.	" March 30, 1911.
——	24,000	"	Ordered.
Armored Cruisers.			
Kongo	27,000	Vickers.	Building.
Haruna	27,000	Kobe.	"
Kirishima	27,000	Nagasaki.	"
Hiyei	27,000	Yokosuka.	Ordered.
Protected Cruisers.			
Shikuma	5,000	Sasebo.	Launched Apr. 1, 1911.
Yahagi	5,000	Nagasaki.	" Oct. 3, 1911.
Hirado	5,000	Kobe.	" June 29. 1911.

JAPAN AND HER NAVY.—Big naval shipbuilding programs still hold their own in the international "fashion" lists, and the latest country to bestir itself in this direction is Japan. It is well-known that, although the "Flowery Kingdom" had soaring naval ambitions when she so triumphantly finished off her war with Russia, yet, since she did not receive a single kopeck of indemnity from the great Colossus of the North whose bubble she so effectually pricked, Japan was left in very straitened circumstances, and had to cut her naval coat according to her financial cloth. The Land of the Rising Sun has not made the same rapid financial recovery as France did after the debacle of 1870, simply because she has not developed industrially to the same extent as our cross-Channel neighbors, but the Mikado and his Ministers have handled the finances of their country with great skill and judgment and now her most progressive citizens believe she can safely go in for naval expansion. The main object of Japan's "big navy" advocates appears to be to have a warfleet as strong as their Pacific neighbor, the United States of America. If this wish is to be gratified, our little ally in the Far East will have to make a very earnest and energetic spurt in her shipyards—or in ours. The Americans have more money, and more facilities for spending it in their own shipyards than Japan has, but it is to be hoped that no such race will be started. What the best friends of both countries would desire to see is the signing of an arbitration treaty which would relieve the two of them from all thought of any such ruinous competition.

Before the Society for the Study of Military Affairs, Captain Oda made the following criticism of the Japanese Navy.

As a war port Sasebo in the southwest should have a complete offensive and defensive organization; on the coast of Corea Chinhai should protect transports passing the strait; there is no longer any reason for maintaining the station at Maizuru.

In regard to matériel, unity of caliber must be sought for in ordnance. Two arms as distinct as the automobile torpedo and the mine should be in entirely different hands. As for the personnel, officers perform duties that do not correspond to their rank. For example, the prefets maritimes have not sufficient authority; a lieutenant-commander is a divisional officer, a commander is an ordnance officer or navigating officer, The duties of the graduates of the naval college are not important enough. It is quite possible to make a more profitable expenditure of the money appropriated for the navy.

The Kobe arsenal has received orders to put a new battleship on the stocks, which is to be paid for out of the complimentary funds. It will be similar in type to the *Kawachi* (18,000 tons) and is to be christened *Fuso* after a cruiser stricken from the list of the fleet. It will be built in the 30,000 ton drydock recently completed in this port to do away with the disadvantages of launching. This is the first large ship to be built under these conditions.

The government of the Mikado is at present constructing four *Dreadnoughts*. Three are being built in Japan: anmely, the *Kirishima* and the *Hiyei* at Nagasaki (the latter has not yet been put on the stocks), and the *Harima*, at the Kobe arsenal.

The *Dreadnought* building in England has been christened the *Kongo*. It is a fast battleship of 27,000 tons. The protected cruisers *Chikuma*, *Hirato* and *Yahagi* are being fitted out in the arsenals of Nagasaki and Kobe.

Two new destroyers and a number of river gunboats will be completed this year so as to be put in commission by the end of the present fiscal year.

The Ministry has decided to increase the appropriation for the annual expenditures of the navy with a view to enlarging the war fleet.

RUSSIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Sevastopol	23,000	St. Petersburg (Baltic Wks.).	Launched June 29, 1911.
Petropavlovsk	23,000	" "	Launched Sept. 9, 1911.
Poltava	23,000	" (Admiralty Yd.).	Launch. July 10, '11.
Gangoot	23,000	" "	Launched Oct. 7, 1911.
1	22,000		Authorized.
2	22,000		"
3	22,000		"

RECONSTRUCTING THE RUSSIAN FLEET.—At last there are distinct signs of a progressive naval policy having been initiated in Russia. Messrs. Vickers (Limited) have booked a contract to build the first Russian *Dreadnought* at Nikolaieff, in the Black Sea, and have undertaken to modernize the shipyard there on the model of the latest British type of equipment. A second order is open to the firm if another company, not named, do not accept similar conditions with another shipyard in the Black Sea. Vickers' firm are now largely interested in shipbuilding operations for Spain, Russia, and Canada. Since the Russian Navy was destroyed in the Russo-Japanese war many difficulties have stood in the way of its reconstruction, and some of these may be enumerated. In the first place, for every officer employed on the active list whose business it was to take the ship to sea when she was built and fitted out. there were six bureaucrats of the

veritable "Tite Barnacle" description, whose generous salaries had to be paid; there was but little work for them to do, but this did not deter them from remaining in their appointments. There is, then, the difficulty about men with whom to man the fleet, and this is really the crux of the whole matter. The Russian fleet has to be manned by land conscripts, with not only no aptitude for the sea, but with an absolute horror of the idea of venturing themselves on this element. Nor is this all. In other countries the training of seamen can proceed day in and day out all through the year, whereas in Russia the Baltic is not navigable for five months out of the twelve, during this time the peasants who are in the process of transformation into sailors are obliged to kick their heels in barracks on-shore, doubtless to their own entire satisfaction. No matter how you dress a man, and no matter what you call him, you cannot make him a seaman in barracks; therefore, if Russia is ever to have a navy worthy of the name, she will have to send her fleet out of the Baltic during the winter months, when Generals "Janvier" and "Février" can be trusted to look after the maritime interests of their country.

In 1908 a new naval policy was initiated by the Douma, which decided in commercial parlance, "to cut the loss" of Russian naval ambitions in the Far East, only maintaining there the local naval defences at Vladivostock, agreeing at the same time to keep in the Black Sea a sufficient force to exercise an effective control between the Russian and Bulgarian coasts. Finally, and after much searching of hearts and seeking of guarantees for efficient administration, it was decided to start afresh in the Baltic, not only by a complete reconstruction of the naval establisments, but also by the building of a new fleet. The question then arose as to what class of vessel was in the future to fly the white flag with the blue St. Andrew's cross. The Admiralty, with sound strategic instinct, averred that only ships of the line were of any use. This was met by a section of publicists, and even officers, who declared for a fleet of cruisers, torpedo craft and submarines, capable of waging a defensive warfare in the confined waters of the Baltic, basing their contention on the fact that it would be so long before Russia could once again show a formidable battleship division, that ere that time arrived the might of Germany would be irresistible. So alluring and so economical was this plan that in the first instance it was adopted by the Douma, who voted a million and a quarter sterling for this purpose.

We cannot blame the national assembly for this decision; they had felt themselves bitterly humiliated by the non-success of the navy in the war, and argued—most unfairly if very naturally—that the blame lay with the officers and men of the fleet; therefore if money was to be spent in the defence of the country they preferred to give it to the army rather than to the navy. Those who have read the books of Vladimir Semenoff will remember that this able and patriotic officer laid to the account of the bureaucrats, and the dishonest administration they represented, the fact of the defeat of the Russian Navy. When inquisition was made this contention was proved up to the hilt, and it required the personal intervention of the Czar before the Douma could be induced to do that which has now been done. Admiral Dikof, who did not fall in with the views of the popular assembly, resigned, and was succeeded by Admiral Voyedvosky. This officer resigned, and was nominated as a member of the Council of Empire, his place being taken by his adjutant, Admiral Grigorovitch, who has been appointed Minister of Marine. The relations between Admiral Voyedvoski and the Douma were not of the happiest description, and it remained for his adjutant to persuade the members, after many delays, to vote the necessary credits for the four battleships to be constructed on the Baltic.

The post of an administrator, through whose hands an enormous amount of public money has to pass, is never a particularly enviable one;

that of Admiral Grigorovitch must be singularly onerous and unpleasant. He has in the first instance to clean the Augean stable which has been left to him. This in itself would seem to be work enough for one man. He has then to create new dockyards and arsenals, train up native workmen to build battleships in these establishments, since it has been decided that the Russian ship must be built in a Russian Yard. This is doubtless extremely patriotic, but the decision having been come to, the Parliament and the nation must be prepared to foot the bill, which will work out at from twenty-five to forty per cent more than is spent in a similar manner in England or Germany.

A Commission of Inquiry which was appointed last year sent in a report this April, in which it was stated that for more than thirty years the credits voted for the upkeep of the fleet have been used for purposes entirely different to those for which they had been allocated; instancing that money for new construction had been used for the patching up of worn-out and useless vessels, and further, that the vessels ordered to be built were kept so long upon the stocks that they had to be altered before they were launched, in order that they might be brought up to date. The program which the new Minister of Marine has submitted for the approval of the Douma lacks nothing in the way of completeness. It comprises twelve battleships of the largest size, five armored cruisers (and the armored cruiser of the present day is nothing but a battleship of extra speed), eighteen fast torpedo craft of from one thousand to thirteen hundred tons, sixteen submarines, and five minelaying vessels—all for service in the Baltic; and three large battleships, nine destroyers, and six submarines for the Black Sea, the whole to cost 96 millions sterling, and to be spread over a period of ten years, acceleration to proceed year by year.

One thing seems to be fairly certain concerning this program, which is that the money will not be sufficient. It would be a difficult matter to provide the number of vessels projected, even if the means of construction were adequate and conducted economically. As this is not the case, the Douma, if it holds to its program, will have to meet considerable sums in "Supplementaries" before the decade expires. There is some reason for this anticipation when we read what has been said in the way of criticism in the *Novoe Vremya* by "Brutus." This writer declares that the new all-big-gun battleships of the *Gangut* type, which were to have been built in forty-five months, and for which the time of completion was in 1910 carried to between four and five years, will, as a matter of fact, take six years and eight months to complete; that their cost which was to have been 57 millions of francs, will be 80 millions, or an outlay of 3450 francs per ton. If. this calculation be correct, it is enough to stagger humanity, when we remember that the *Dreadnought,* the experimental vessel of the all-big-gun type cost £100 per ton to build, and that the later types are somewhat in the neighborhood of £80 per ton. If the calculations and the anticipations of "Brutus" are correct, Russia will be paying over three million sterling per battleship.

These prognostications seem somewhat unduly gloomy, as the first of the *Gangut* class, the *Sevastopol,* was launched on the Neva on June 29; the second, the *Poltava,* on July 10; while the last two, the *Gangut* and the *Petropavlovsk,* are to be launched on August 28 and October 28 respectively. As they were laid down in June, 1909, and as at the moment of launching the *Sevastopol* had a displacement of 8230 tons, we might reasonably expect that this vessel, at all events, will be completed for sea in less than four and a half years. We are, however, compelled to note the case of the *Andrei Persoswanni,* which was laid down at the Baltic Works in January, 1903, and the *Imperator Pavel,* begun in the same yard in September, 1903, and which, after alterations that have taken place, are now, in the second half of 1911, beginning their trials! They are of the

Lord Nelson type of the British Navy—or, rather, they approach that class nearer than any other—and it was this class which immediately preceded the all-big-gun type of vessel. They are therefore actually obsolescent before they have begun their trials. In the Black Sea the two battleships of the *Iefstafi* class which have just reinforced the Russian fleet in that sea, have been under construction at Nikolaieff and Sevastopol since 1903.

Russia has viewed with alarm the purchase by Turkey from Germany of the *Kurfürst Friedrich Wilhelm,* and the *Weissenburg,* and is still more exercised at the order by that nation for two *Dreadnoughts* in England. It is plain that if the navy of the Czar is to make head against the Turks it will mean the complete reconstruction of her dockyards in the Black Sea. It is possible, of course, that Russia may, in self-defence, resort to ordering battleships abroad. However this may be, one thing is certain: that unless the new Minister of Marine can make headway against the bureaucracy, can introduce economies—which in plain English means the dismissal of about 50 per cent of the incapables who batten upon the credits voted for naval purposes—and unless he is supported by the whole force of public opinion—such as it is in Russia—as well as by the votes of the Douma, then his mission will be a failure. Admiral Grigorovitch has on his hands the biggest contract of any man in Europe. We admire him for the dauntless courage and enlightened patriotism, which has caused him to take it up, and heartily wish him success in the difficult task that lies before him.—*The Naval and Military Record.*

THE RUSSIAN NAVY.—The silver keel-plates have been laid at Nikolaieff, by Admiral Grigorovitch, Minister of Marine, of the three battleships of which it was announced some time since were to be built for the Black Sea Fleet. This ceremony indicates that difficulties have been overcome, but the keels of the ships will not be put down for some months, though work will proceed with the essential parts in the interim, so that progress may be rapid. The period of construction is stated to be four years, but it is not known exactly what this implies—probably from the present time to the completion of acceptance trials. The shipbuilding concerns on the River Boug have been reorganized, and while one group, that of the Chantiers Navals, is under the control of Messrs. Vickers, the other represents the interests of Messrs. John Brown, of Clydebank. The latter will build two ships to be known as the *Emperor Alexander III.* and the *Empress Marie,* and the latter the third ship to be known as the *Ekaterina* or *Catherine.* These ships requiring coal capacity sufficing for the Black Sea, will probably displace 22,500 tons, but will be in every way equal to the new Baltic ships, with some improvements. They are credited with an armament of twelve 12-inch guns and a speed of 21 knots.—*The Naval and Military Record.*

THE RUSSIAN NAVAL DEVELOPMENT.—The first stone has been laid of a great basin at Cronstadt, which is to be named after the heir to the Russian throne, Prince Alexia Nicolaievitch. The basin will be 836 feet 8-inches long, and 35 feet 8-inches deep below the ordinary water level. The Russian Minister of Marine has proposed an extension of the Russian Admiralty yards in the Gabeeren Isles. The land proposed to be acquired, and the buildings to be built, will involve an estimated outlay of 1,080,000*l.*—*Engineering.*

LAUNCHING OF THE "PETROPAVLOVSK."—On the ninth of this month the Czar, surrounded by members of the Imperial family and his Ministers, gave the signal for the launching of the third *Dreadnought.* The ceremony took place amid the salvos of the cruiser *Makaroff's* guns and the enthusiastic cheers of the crowd that thronged the banks of the Neva.

The *Petropavlovsk* glided majestically into the waters of the stream, taking its place with the two *Dreadnoughts* already launched and about to receive their armament. Those present received the vivid impression that the Russian fleet would soon occupy a prominent place among the navies of the world.

At the launching, Admiral Grigorovitch, Minister of the Navy, said the following:

"Russia must regain the control of the Baltic, acquired two hundred years ago." These words show an irrevocable determination to contest the superiority of Germany in these waters.

The *Petropavlovsk* is six hundred feet long, and has a displacement of 23,000 tons, and a speed of 23 knots. Its armament will consist of 12 guns of 305 millimeters, and 7 of 120 millimeters.

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
España	15,400	Ferrol.	Building.
Alfonzo XIII.	15,400	"	"
Jaime I	15,400	"	Ordered.

TURKEY.

When pitted against a power like Turkey, the powerful Italian pre-*Dreadnought* fleet assumes formidable proportions. Among these ships are the *Emanuele Filiberto* and *Ammiroglio di Saint Bon,* of 9800 tons and 18 knots speed; the *Regina Margherita* and *Benedetto Brin,* of 13,400 tons and 20 knots; the *Regina Elena, Vittorio Emanuele III., Napoli,* and *Roma,* of 12,600 tons and 22 knots speed; and the armored cruisers *Giuseppe Garibaldi, Varese,* and *Francesco Ferrucio,* of 7400 tons and 20 knots. The *Emanuele Filiberto* and *Marco Polo,* which left Taranto on Saturday with sealed orders, were launched respectively in 1897 and 1892. The former has a displacement of 9800 tons, and her main armament consists of four 10-inch, eight 6-inch, and eight 4.7-inch guns. She has two sets of 3-cyl. triple-expansion engines, her machinery having been made in Italy from British designs. The *Marco Polo's* six 6-inch and four 4.7-inch guns are not of recent pattern. Her displacement is only 4583 tons. Italy is well provided with torpedo boats, destroyers, submarine boats, mine-laying vessels, etc., and her navy easily ranks sixth in importance when compared with the other powers.

Turkey only possesses three inferior battleships—namely, the *Torgut Reis* (ex-*Weissenburg*) and *Kheyr ed din Barbarossa* (ex-*Kurfürst Friedrich Wilhelm*), bought from Germany, and the *Messudieh,* built in 1874, and rebuilt in 1904 by Ansaldo. There are several other old ironclads which are belived to be useless or nearly so. The *Hamidieh* and *Medjidieh* are protected cruisers of 3800 tons and 22 knots, built in 1903, the first at Elswick the other by Cramp, of Philadelphia. As the *Morning Post* reminds us, in December 1908, Rear-Admiral Gamble was lent to the Turkish Government, in order to reorganize the navy, but returned to England in February, 1910. He was succeeded by Rear-Admiral Hugh Williams, who is still in Turkey. Little news has been heard of what progress has been made, but it is understood that Admiral Williams' duties are concerned only with thetraining of the personnel, and that he is not naval advisor on all matters as his predecessor was. Turkey recently ordered two *Dreadnought*-class battleships in England, but these are not yet even laid down.—*Pages Weekly, Oct. 6.*

UNITED STATES.

VESSELS BUILDING.

No.	Name. *Battleships.*	Speed. Knots.	Where Building.	% of Completion Sept. 1.	Oct. 1.	Nov. 1.
30	Florida	20¾	Navy Yard, New York.	98.6	98.6	
32	Wyoming	20½	Wm. Cramp & Sons.	77.5	80.	83.9
33	Arkansas	20½	N. Y. Shipbuilding Co.	72.8	75.3	78.
34	New York	21	Navy Yard, New York.	4.5	8.9	22.1
35	Texas	21	N'pt News S. B. Co.	3.0	34.9	39.4
35	Nevada			Authorized.		
37	Oklahoma			"		

The United States Navy Department has given an order for 180 torpedoes to the Whitehead Torpedo Company, and Commodore Volney O. Chase, who has been in command of the torpedo practice ship *Montgomery*, has been detached from that duty and ordered to England to superintend personally the construction of the torpedoes. This is the largest order for torpedoes that has ever been placed at one time by the American Government, and approximately 12 months will be required for their manufacture and delivery.—*United Service Gazette.*

Before a single gun of the 14-inch caliber has been manufactured in the United States, preparations are being pressed forward for the construction of an even greater weapon. Preliminary estimates and other computations for the construction of 16-inch guns for the navy are being made by Rear-Admiral Nathan C. Twining, Chief of the Bureau of Ordnance. It is not expected that the navy will have any immediate use for 16-inch guns, but owing to reports that are current that some other nations —particularly Great Britain and Germany—are working on guns of larger caliber than 14-inch that are now used in the main batteries of first-class battleships of the United States fleet, it is thought wise to prepare to meet any such increase. Admiral Twining is determined not to be caught napping, if, owing to the action of the foreign powers, the Secretary of the Navy should decide that the 14-inch gun is not sufficiently powerful. According to statements emanating from the Ordnance Department of the United States, the projectiles of this new gun will weigh 2400 pounds, and is expected to penetrate the thickest armor plate with the greatest ease, and to burst on the inside of the battleship with the force of about 140 pounds of high explosive. One shot from the 16-inch gun, in the opinion of ordnance experts, would put the largest *Dreadnought* out of effective action, if it did not sink it. In print a 16-inch gun does not appear so much larger than a 14-inch gun, but the weight of a projectile from a 14-inch gun is 1660 pounds, against 2400 pounds for the larger caliber. A 14-inch gun will carry not more than 90 pounds of high explosive, while the projectile of a 16-inch gun will contain between 140 pounds and 150 pounds. Since the 13.5-inch gun is now actually entering our own active fleet, while Germany is said to have started the manufacture of a 14-inch weapon, and the United States purposes mounting a gun of similar caliber in the two battleships recently authorized by Congress, it is not by any means improbable that public opinion in the United States will compel the American Government to adopt a 16-inch weapon. It is even possible that this new gun will form the basis of a compromise between the advocates of two battleships next year and those who contend that one battleship is adequate. It may be decided to lay down an experimental ship carrying 16-inch guns. In this event, however, the completion of such a unit would be considerably delayed owing to the long time which must elapse before the trials of such a new weapon can be completed.—*Naval and Military Record.*

NAVAL OBSERVATION TOUR.—*A Favorable Impression.* Mr. Meyer, Secretary of the United States Navy, who made a recent tour of observation in England, expressed himself as follows on his return to New York:

"I visited two of the largest Government navy yards, three shipbuilding plants on the Clyde, near Glasgow, and the Vickers yards at Barrow. There was a willingness everywhere to furnish information. I had conferences at the Admiralty in London with leading officials on matters of administration concerning the navy yards and the relations of the Admiralty with the fleets. I was attracted by the success in the Admiralty and the British Navy generally in abbreviating and simplifying correspondence, and I shall continue my previous efforts in that direction in our service.

"I found much to learn from the more humane way desertion and leave-breaking are handled and punished in England. I visited the detention barracks at Chatham, under the jurisdiction of the navy, and the barracks at Aldershot, under the jurisdiction of the army. It is at these barracks and similar ones that men are punished for offenses against discipline by continued occupation at drill and useful work during the whole of each day. The punishment periods are short, but a man so punished never wants to go back to it; he is kept so busy.

"No prison garb is worn, and though the men are confined in separate rooms, there is an absence of the brutalizing influence of a prison. I shall make an effort to establish the detention system as far as possible on these lines in the American Navy. A small start has been made in this direction, but much remains to be accomplished, and some legislation along more humane lines will be necessary, and I believe the Congress will be in sympathy with this.

"They are building in England and other countries large, fast armored cruisers of 27,000 tons, and with a speed of 28 knots, with which we have as yet nothing to compare. There has been some talk in our newspapers of a reaction toward smaller battleships in the British Navy, but I found no signs of such a tendency in England, nor any belief that reduction in size would take place in any navy.

"In studying the organization of the British and other leading fleets, I noted that all had the proper number of admirals of suitable rank, while in our country, we have nothing but rear-admirals. I believe we should have at least vice-admirals, if only to give the country proper recognition when our fleets meet foreign fleets at home or abroad."

A Press dispatch from London, under the date of September 16, says:

"Describing his recent visits to British dockyards, Secretary Meyer is reported to have expressed his special interest in the shipyards of Messrs. Yarrow & Co. because of the similarity between the circumstances which caused the removal of this firm's works from the Thames and those which exist today in regard to some of the United States Navy Yards.

"No doubt what Mr. Meyer has seen in England will confirm his views as to the need for closing down certain American yards, and in any case he must have found many arguments in support of such a policy in the history of the British Establishments.

"The reasons upon which the Secretary advocates this reorganization are not only economic, but strategical as well. Similar reasons led to the closing of the British dockyards at Woolwich and Deptford, historic establishments which built the entire fleet of Queen Elizabeth that defeated the Spanish Armada.

"Fifty years ago Woolwich Dockyard had an area of 56 acres and Deptford 38 acres, but both were closed for building, repairs, and docking purposes in 1860-70, Woolwich being allocated to the Naval Ordnance Department and Deptford transformed into a victualling yard and depôt. At one time there were public shipyards also at Harwich, Deal, and Kinsale, but these have now disappeared.

"Similarly, within the last ten years Sheerness and Pembroke dockyards have only been saved from extinction by their use for the building or repair of small craft like scouts and destroyers, neither yard having a dock that could take a modern armorclad. On the other hand the dockyards of Portsmouth, Keyham (an adjunct of Devonport), and Haulbowline (Queenstown), have grown steadily in the same period, while an entirely new yard is being created at Rosyth, on the east coast of Scotland, and a first-class naval harbor has been provided at Dover.

"British establishments abroad have also been reduced in consequence of the new strategical policy of the Admiralty, which substituted fewer and larger ships, able to come home for refit and repair, for the numerous small ships which required expensive dockyard establishments to be maintained abroad for their use and equipment. Among the yards so abandoned or reduced were those at Trincomalee, Ascension, and Port Royal, while the yards at Halifax, Nova Scotia, Esquimalt, and Bermuda are now under the control of the Canadian Government.

"But it is not always the views of naval officers and adminstrators that are carried out, for in England, as in France and America, political influence exerted by those directly interested in the locality affected has stopped the progress of measures intended to promote naval efficiency.

"Such exaltation of vested and private interests over national interests must always be deplored, but the idea that the navy yards exist for the fleet and not the fleet for the yards is a very hard one to drive into the minds of the people."—*Naval and Military Record.*

After visiting foreign navy and shipbuilding yards, Secretary of the Navy Meyer has returned convinced that the Vickers Co., of England in its yards at Barrow-in-Furness comes nearest supplying a model organization for copying in this country. As a result he has sent Captain A. B. Willetts and Captain E. Theiss, U. S. N., to make a more detailed study of the plant with a view to reporting suggested changes in our own organization. In the meantime Naval Constructor Holden A. Evans, U. S. N., has been ordered to Norfolk to assist in carrying out written instructions to the commandant for improvement in the issue and care of tools, handling of material, estimating on work and repairs, and in bringing about uniform methods in all shops. Mr. Meyer has no idea of making any changes in the organization in navy yards.—*Shipping Illustrated.*

UNITED STATES BATTLE PRACTICE.—The battle practice of the American Fleet began with the remarkable firing of the *Delaware* at the *San Marcos,* hits being made at between 15,000 and 16,000 yards, and no ranges less than 16,000 yards being tried. The same vessel was to carry out further firing of the same character, and two ships only were to fire competitively each day. There has also been experimental and night firing, and there was an expectation that by extending the firing over a period of 10 or 15 days rough weather might be encountered during part of the period. It was thought very desirable that the ships should do their work in difficult weather, and when rain, mist, and fog partially obscured the view. The smooth water methods of training have been abandoned, and officers are now required to do their firing in difficult conditions in the open sea. Elementary practice is no longer in vogue, and two battle practices will take place every year. There is to be no firing this year at ranges under 9000 yards. A great deal of work has been done in firing torpedoes in the open sea from battleships, destroyers, and submarines, and results have far exceeded expectations.—*Army and Navy Gazette.*

ORDNANCE AND GUNNERY.

AMERICAN GUNNERY.—The firing at the *San Marcos* and some other circumstances have latterly caused special attention to be directed to the subject of gunnery in the American Navy, which is generally believed to have attained a very high level of efficiency. Excellent results seem to be attained without any very strenuous methods of preliminary training. The principal work takes place on board the ships, it being thought that the close relations between officers and men working under a system of control presents a considerable advantage. An appeal is made to the sporting element in the men, who are stimulated to keen emulation by money prizes and distinctions. The best shooting ship flies a particular flag, and turrets which have done the best shooting have the letter "E" painted upon them to signify "Excellent." Gunnery is constantly practiced on board, and when the men have gained a respectable degree of practical efficiency, the ships undertake further exercises, including calibration, gunlayers' tests, and battle practice. The gunlayers' tests are at a range of about 2000 yards, and the battle practice includes individual firing of ships, followed by divisional firing. The fire is directed in battleships by a lieutenant-commander as "ordnance officer," with a "ranger," "spotter," "tracer," and "sub-station superintendent" as his assistants. The object is to open effective fire at long range, and the lattice masts provide an elevated platform for the work of the ranger and spotter. Usually the captain confines himself to indicating the objects and the times for opening and ceasing fire. What special system of fire control exists seems not to be known. Generally the range being found, say, at 12,000 yards, trial rounds are fired, and the spotter on his platform at a height of about 100 feet above deck indicates errors by observing through proper glasses the fall of projectiles. If the platform should become untenable, the spotter would retire to a secondary station. The ordnance officer, in a central protected station, receives, by voice pipe or telephone, the range from the range-finding officer, and the angle of approach or otherwise from the tracer, and has graphic appliances for recording them. He then transmits the information by voice or optical signal to the stations of the guns. The system is centralized and yet disseminated. Very great confidence is felt in the spotter's ability to observe the fall of the shell, and in the methods of transmitting orders. There seems to be in general no individual firing, all the operations being conducted under a rigid system of fire control.

General satisfaction will be expressed at the decision of the Admiralty to utilize some of the old second-class torpedo-boats as practice targets. They are to be used during night firing, an indication of the importance which the Board attach to this branch of naval training. The boats are being gutted and filled with cork and other material so as to render them unsinkable, while above the upper deck canvas and wooden structures are being erected so as to cause them to resemble the target a modern torpedo vessel offers during night operations. When completed, these targets will be towed past firing ships at varying speeds at night and at different angles of bearing, so as to provide the most realistic practice. The Admiralty's decision suggests the inquiry whether the authorities could not do better than put up to auction the old battleships which are now passing out of the service.—*Naval and Military Record.*

BATTLE PRACTICE.—The illness of Sir Francis Bridgeman and Rear-Admiral Bayly, both of whom we are glad to learn are progressing satisfactorily, has left Rear-Admiral Peirse in command of the First Division while the battle practice is being carried out. It is a coincidence that this should have happened, seing that twelve months ago Admiral Peirse was himself Inspector of Target Practice, and was therefore present during

the battle practice in another capacity. He embarked with his staff, augmented for the purpose, in the cruiser *Hogue,* and likewise his successor, Captain Montague Browning, had the *Euryalus,* a sister ship, under his orders while the fleets are engaged in battle practice this year. It is not until 1910 that the Inspector of Target Practice had a special ship set apart for his use in this way, but the inovation only indicates the extension and development of the scope of his office since it was first established in 1905. This growth was remarked upon at length in one of the chapters of the last issue of the *Naval Annual,* in which the writer showed how, under the guidance of Sir Arthur Wilson, the tendency, already manifest in the time of Lord Fisher, to divide gunnery administration into two branches—making the Director of Naval Ordnance the Board's adviser as to material, and the Inspector of Target Practice the Board's adviser as to technique—had shown a distinct advance. Along this line the office of Inspector of Target Practice has grown gradually but continuously until it has become of great value to the service. With a permanent staff for the purpose, the shooting of the fleet can be analyzed from year to year, and every innovation or change of method or appliance reported upon, while the inspector and his subordinates, who are brought into contact with each captain and his gunnery organization, can collect and co-ordinate the experience of the whole fleet. This data in turn must be valuable to the Ordnance Department which supplies the guns, and to the gunnery schools which train the officers and men in the use of them.—*Army and Navy Gazette.*

NEW METHOD OF FIRE CONTROL.—In the forthcoming battle practice, which is always the chief feature of the autumn work of our home fleets—if all the heavy and light gun competitions have been carried out in the spring, which is usually the case—it is expected that the battleship *Neptune* will be able to give a better account of herself than most of her sister battleships, provided the new Scott's concentrating and rapid-firing gun is brought into operation. It will be remembered that some important gunnery experiments were carried out immediately after the *Neptune* was commissioned for sea service, which demonstrated that a new arrangement had been devised by one of our cleverest gunnery experts, which increased both the rapidity and accuracy of 12-inch gun-fire in a marked degree. Improvements have since been made, and it is probable on account of the very regrettable illness of that keen gunnery admiral, Sir Francis Bridgeman, that further trials have not taken place. In the battle-practice test, however, it will probably be found that the system will be used with a view to show its superiority over the old methods of firing, and if it is in the hands of capable experts, as in all probability it will be, then it will have a fair chance of showing how far forward this new arrangement of fire control will carry us. As regards the position in the fleet gained by such advantages, the authorities will probably take care to see that the prizes and credit for good performance are arranged in a manner to secure justice all-round. The important point is to test the new method with the old, and see what ground has been gained.—*Army and Navy Gazette.*

CONCENTRATING GUN FIRE.—We have already dealt with the value of concentrated fire, and given our reasons for holding that the middle-line system of placing the turrets for primary guns will in future be continued in the British Fleet, no matter whether the twin-gun turret be adhered to, or a triple-gun or four-gun turret be eventually adopted by our gunnery experts and designers. There is another important point in connection with getting the most effective gun fire that a ship is capable of, and that is the system by which gun fire is arranged and controlled. It must be confessed that the British system has in the past been in a somewhat unsettled and unsatisfactory condition, owing to the great latitude

allowed to the gunnery officers of the fleet in working out their own ideas—in their own ships—as to the best method to arrange and control gun fire. Experiments have been carried out in a sort of haphazard manner ever since the *Dreadnought* came into existence, and only reached what looked like its climax, and the dawn of a more fixed and better state of affairs, during the carrying out of a series of experimental gunnery trials in the battleship *Neptune*, shortly after she commissioned, a few months back, for her first period in the fighting line.

While the *Neptune* was experimenting with controlling apparatus for the primary guns, it leaked out that Vice-Admiral Sir Percy Scott was on board, and that a system which he had invented had been under trial, and had proved highly successful in conrolling gun fire and in increasing its rapidity and accuracy. The system came through an exhaustive test exceedingly well, and although there were improvements which suggested themselves as the experiments proceeded, yet the system proved to be such a great gain in nearly all directions, over every other system previously tried, that there can be but little doubt that Sir Percy's methods of controlling and arranging gun fire, from the primary armament, will be the one to come into general use throughout the whole of the British Fleet, and so systemize what has been more or less a go-as-you-please, or haphazard way of controlling the fire from heavy guns.

But our navy was not alone in lacking a successful and uniform system of control before the advent of Sir Percy Scott's method, for the Germans, always secretive, have been unable to adequately or effectively conceal their methods, and undoubtedly their perplexities have been as trying as ours; and, so far as is known, they have not yet found a gunnery admiral to solve this problem as Admiral Scott solved it for the British Fleet. The Germans adopted a system of firing their primary guns in succession from forward, or aft, according to the direction of the wind, so that the smoke of one pair of guns should not interfere with the firing of another pair; and then, when all the primary guns had been fired, they proposed to fire a broadside from the secondary armament. But good as this beautiful theory looked on paper, it was found in practice that the system was nothing short of complete failure, for the foremost guns were always ready to be fired again long before the other primary guns had their turn. Obviously this system wastes time and prevents the maximum amount of fire being extracted from the primary armament, while the secondary armament never comes into play at all without sacrificing primary fire.

It takes our bluejackets from 15 to 20 seconds, only, to load a 12-inch gun, while a 5-inch or 6-inch gun takes only eight or ten seconds. The full rate of fire which German ships should develop has, therefore, never been approached, and the British Navy stands out as supreme in rapidity and accuracy of controlled fire, as arranged in the *Neptune*. Sir Percy Scott's system, which consists of firing broadsides of half the armament, developed a rate of fire with the 12-inch guns of as much as 20 rounds per minute; and this rate allowed each gun forty seconds to load, which shows that under the most favorable conditions, a better rate than 20 rounds of 12-inch per minute from the ship could be developed, as 30 seconds only are required to prepare each of these weapons for a second round from the moment of firing the first round.—*United Service Gazette.*

GUN ACCIDENTS FROM BACK-FLAME.—Our entente friends have had quite a run of bad luck in their naval affairs during the last few years, and this misfortune includes the destructive explosions which caused the loss of two first-class battleships of fairly modern build, the striking of a capital ship on the ways while being launched, submarine accidents, and several gun explosions which have cost life and limb. The latest of these gun explosions, or to speak more correctly, the explosion of gun-charges near the gun, was in the armored cruiser *Gloire* recently, while gun prac-

tice was being carried out on board that vessel. Apparently the gun at which the accident took place was firing at an object that lay dead to windward of the weapon, and so when the breach was opened the wind naturally blew through the bore and forced all the back-flame and noxious fumes from the gases, into the mouths and down the throats of all the men standing in rear of the gun. The back-flame also burnt some of the men, and, worse still, set two gun charges that lay near alight, and caused an explosion which killed three men outright and severely injured 11 others; some of which latter have since died. The gunnery lieutenant was among the injured. Such accidents as this have occurred in nearly all first-class navies, including our own. The precautions adopted in our own fleet now, and which have so far been effective in preventing further accidents of this kind, are, first, to avoid ever having exposed charges in rear of the gun when firing; second, in all large guns to force a strong current of air through the bore directly the gun is fired and before the breech is opened, so as to force all flame and fumes out of the muzzle; and third, with smaller guns to train the muzzle of the gun away from the wind before reloading.— *United Service Gazette.*

ARMOR PLATE MANUFACTURE.—Some interesting figures relative to the cost of armor plate manufacture were given by the Rome correspondent of the *Times* the other day. The Italian Government invited tenders for the supply of 4100 tons of armor plating for the Italian Navy, and as a result the contract was awarded to the Carnegie Steel Company, whose price was 2132 francs a ton. The next lowest tender was that of a French group represented by Messrs. Schneider, who offered to supply the armor at 2465 francs a ton; then came Messrs. Cammell Laird, whose price was 2465 francs; and lastly Krupp, who offered to supply the armor at 2700 francs. It was not stated whether the armor required was of the heaviest class, or only for deck plating; probably it was for the latter or some secondary purpose, as 4000 tons of the thickest armor would not be much more than enough for one vessel. The main point of interest, however, was the securing of the contract by an American firm at a price (about £84 10s. per ton) much lower, not only than the British firm's tender for the same contract, but considerably below the price usually paid by our own Admiralty for armor plate. Supposing the armor required by the Italians to have been for deck purposes, it is conceivable that the Carnegie Company would make an effort to push their new vanadium plates, but no explanation of this kind can be given for the low price of the French tender. The British firm's offer amounted to £105 17s. a ton, whereas it is understood that £120 a ton is the usual price paid for the armor of British vessels. But unless more is known about the type and quality of the armor supplied to the Italians it would be inadvisable to draw too sweeping conclusions on such a matter.—*Army and Navy Gazette.*

A TELESCOPIC SIGHT FOR MACHINE-GUNS.—The importance of fire from machine-guns is generally recognized, but various difficulties have hitherto stood in the way of using an accurate telescopic sight, the principal one being the mirage from the barrel and water-jacket, which affects the telescope more than the open sight. Messrs. Zeiss, of Jena, have now brought out a sight which promises to overcome this difficulty. It is a vertical prismatic telescope with horizontal object-glass and eyepiece, so arranged that the object-glass is well away from the hot jacket. It magnifies only two diameters, and has a field of no less than fourteen degrees. The elevation is given on a circular dial, and the sight can be cross-levelled to eliminate the error which would otherwise result when firing from sloping ground. In view of the importance attached nowadays to machine-gun fire, the new sight should prove a valuable addition to these weapons.—*Army and Navy Gazette.*

DISPOSITION OF GUNS IN DREADNOUGHTS.—*Foreign Navies are Adopting the American Center-line Plan.* By Percival A. Hislam.—The total number of ships of the all-big-gun type now built, building, or provided for in the current year is exactly one hundred. Great Britain leads with thirty-two (which includes two cruisers building at the cost of Australia and New Zealand), followed by Germany with twenty-one, and the United States with twelve. Japan, having this year placed orders for no fewer than five ships of the type (one building in England and four to be laid down in Japan), has increased her total to seven. Russia, France, Italy and Austria have four ships apiece, none being yet completed, and the first-named power proposes as soon as possible to raise her total to twelve. Brazil and Spain each possesses three *Dreadnoughts,* two of the Brazilian only being completed; and the list is completed by the Argentine Republic, with two ships on the stocks; Turkey with two recently ordered in England; and Chili with two which are shortly to be placed out to contract.

In this total of a hundred ships there are thirty-one whose details either have not yet been decided upon or are not yet known. The policy of secrecy, inaugurated by Great Britain with her pioneer *Dreadnought,* has been followed by several other powers. Germany conceals the particulars of her new warships very successfully, and only nine can be spoken of with any certainty. Latterly, Great Britain has relaxed the policy, and the only vessels whose details are uncertain are the five of the 1911-12 program. Nothing is known of this year's quintet of Japanese ships except that they will carry 13.5-inch guns; and other ships where similar lack of knowledge exists are the new American vessels to be laid down this year (which, it is expected, will have ten 14-inch guns in two twin and two triple turrets), the last two of the four Austrian vessels, the Turkish and Chilian ships, and the Brazilian *Rio de Janeiro.* The last named vessel was for some time reported to be designed to carry twelve 14.3-inch, fourteen 6-inch and fourteen 4-inch guns; but it has latterly been stated that she will after all be no more than a replica of the *Minas Geraes* and *Sao Paulo.*

In the case of the sixty-nine ships whose principal details are known, there is a very wide divergence in the mounting of the main battery. This would necessarily follow from the fact that some are armed with eight, some with ten, some with twelve, and three even with thirteen heavy guns; but there are also considerable differences even among ships with the same number of guns.

The first *Dreadnought* to be laid down and completed—the British ship of that name—has ten 12-inch guns so arranged as to produce a broadside efficiency of 80 per cent (Fig. 10). Three turrets are on the center line, and so can bear on either beam; but the other two are placed abreast on the beams, so that each can bear on only one broadside. In a broadside engagement, therefore, two guns out of ten would be useless. In spite of the obvious drawbacks of the arrangement, however, it was repeated in six later ships—*Bellerophon, Temeraire, Superb, St. Vincent, Collingwood* and *Vanguard;* and the result is that these seven ships, if they formed one battle unit, would have no fewer than fourteen 12-inch guns out of seventy useless for a line-ahead action.

The seven British ships are the only five-turreted *Dreadnoughts* which cannot dispose 100 per cent of their heavy guns on the beam. The American five-turreted ships *Delaware, North Dakota, Florida* and *Utah* (Fig. 6) have all their turrets on the middle line, with the result that these four ships, mounting ten 12-inch guns apiece and forty in all, are equal in broadside action to five of the British ships mounting fifty 12-inch guns, since only forty of these could be brought to bear on the beam. We are not dealing here with secondary batteries; but the best five of these seven British ships mount ninety-two 4-inch all told (twenty each in the *St. Vincents,* and sixteen in the *Bellerophons*), while the four American vessels

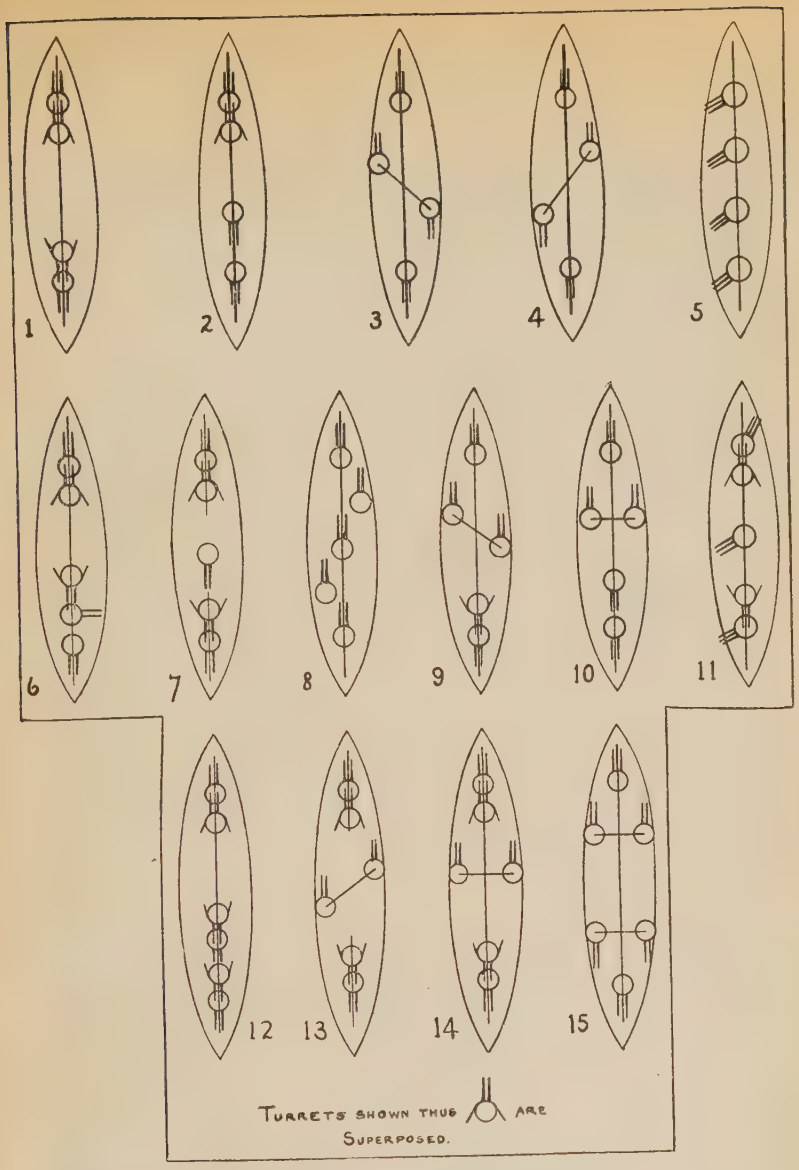
have sixty 5-inch which, allowing for the much greater power of the 5-inch gun, is in all probability a superior equipment. In her later vessels Great Britain began to show signs of being influenced by the full-broadside argument. Its force was, however, admitted grudgingly, and a wavering effort made to combine a full broadside with a heavy fore and aft fire. The *Neptune, Hercules* and *Colossus* were the result (Fig. 9). These ships, like the earlier *Dreadnoughts,* have three turrets on the middle line, but the wing pair are placed *en échelon* across the deck amidships, while the last turret but one from aft is superposed to fire over the aftermost. The result is that six guns can be fired ahead and eight aft is superposed to fire over the aftermost. Over a large angle, however, the fire of the port turret is masked on the starboard side by the starboard turret, and *vice versa,* and the lengthy experiments which were carried out in the Mediterranean early this year are believed to have proved that the compromise is not a very happy one.

At any rate it has been abandoned in later ships. The *Orion, Thunderer, Conqueror* and *Monarch* (1909-10 program), and the *King George V, Centurion, Ajax* and *Audacious* (1910-11 program), will have ten 13.5-inch guns in five turrets, all on the center line. The second from forward will be superposed, so that four guns will bear forward; and the same arrangement is repeated aft, the fifth turret being amidships (Fig. 7). In these ships, therefore, Great Britain for the first time acknowledges the superiority of the all-on-center-line system which has been applied to American *Dreadnoughts* since the first was designed. The ten 14-inch guns of the *Texas* and *New York* will be mounted on thin plan.

The last of the known five-turreted ships are the Italian vessels *Conte di Cavour, Leonardo da Vinci,* and *Giulio Cesare.* In the case of the last two it is possible that the original design may not be adhered to, but they were all designed to carry, and the *Conte di Cavour* at any rate will be equipped with thirteen 12-inch guns arranged as shown in Fig. 11 of the diagram. There will be three three-gun turrets, one forward, one aft and one amidships, and two twin-turrets will fire over the fore and aft turrets respectively. There will thus be a full broadside fire of thirteen 12-inch guns, while five will bear ahead and astern. If this arrangement is not carried out in the other two ships it will be to allow of the mounting of heavier guns. It may be mentioned that the guns in the triple-turrets are arranged on two levels, two being below, and the third above and between them. In this way the breadth of the turret is saved at the cost of additional height.

There are comparatively few four-turreted *Dreadnoughts.* The first were, of course, the American *Michigan* and *South Carolina,* although for various reasons they were not at sea until after the British *Invincible* cruisers. The *Michigans* have eight 12-inch guns in four turrets, two forward and two aft, the one nearer the middle of the ship being superposed in each case (Fig. 1). The British *Invincible, Inflexible* and *Indomitable* also have a nominally full broadside (Fig. 3), two turrets being on the center line, and two *en échelon* amidships; but the latter (as in the *Neptune*) are so close together that the arc covered by eight guns is very small. In the *Indefatigable* this fault was to a certain extent remedied, by increasing the distance between these two turrets; but the authorities were finally driven to adopt the American system, and the *Lion, Princess Royal* and *Queen Mary* are the result. (Fig. 2). These ships have eight 13.5-inch guns in four middle-line turrets, the second from forward being superposed. Only two guns, therefore, can fire aft, as compared with six in the previous cruiser-*Dreadnoughts* built for the British navy.

The *Indefatigable* system has been followed by Germany in the case of the *Von der Tann* (cruiser), and by Spain in the battleships *España, Jaime I* and *Alfonso XIII.* The *Von der Tann* has eight 11-inch guns and the Spanish vessel eight 12-inch; and in each the longitudinal space



1. Michigan, South Carolina (U. S.), 12-in.
2. Lion, Princess Royal, Queen Mary, (British), 13.5-in.
3. Inflexible, Invincible, Indomitable, Indefatigable, New Zealand, Australia, (British), 12-in.
4. España, Jaime I, Alfonso XIII (Spanish), 12-in. Von der Tann (German), 11-in.
5. Gangut, Poltava, Petropavlovsk, Sevastopol (Russian); Viribus Unitis, "V" (Austrian); Dante Alighieri (Italian), all 12-in. Plan 3, with tripple turrets, has been suggested for Russian ships.
6. Delaware, North Dakota, Florida, Utah (U. S.), 12-in.
7. Texas, New York (U. S.), 14-in.; Orion, Thunderer, Conqueror, Monarch, King George V, Centurion, Ajax, Audacious (British), 13.5-in.
8. Plan suggested by Mr. James McKechnie (of Messrs. Vickers) for 16,000-ton ship fitted with internal combustion engines.
9. Neptune, Hercules, Colossus (British), 12-in.
10. Dreadnought, Bellerophon, Temeraire, Superb, St. Vincent, Collingwood, Vanguard (British), 12-in.
11. Conte di Cavour, Leonardo da Vinci, Giulio Cesare (Italian), 12-in.
12. Wyoming, Arkansas (U. S.), 12-in.
13. Moreno, Rivadavia (Argentine); Minas Geraes, Sao Paulo (Brazilian), 12-in.
14. Courbet, Jean Bart, France, Paris (French), 12-in.
15. Kawachi, Settsu (Japanese). 12-in.; Nassau, Westfalen, Rheinland, Posen (German), 11-in.; Ostfriesland, Helgoland, Thüringen, Oldenburg (German), 12.2-in.

THE DISPOSITION OF GUNS IN DREADNOUGHTS.

between the *écheloned* turrets is much more than in the British ships, while the starboard turret, instead of the port, is nearer the bows (Fig. 4). The British cruisers *New Zealand* and *Australia,* building for Pacific service, are similar to the *Indefatigable.*

The other known four-turreted ships are equipped on the triple-turret system, which has lately come into considerable vogue. All are armed with twelve 12-inch guns, their names and nationality being: *Petropavlovsk, Poltava, Sevastopol and Gangut* (Russian), *Dante, Alighieri* (Italian), and *Viribus Unitis* and a vessel at present known as *V* (Austrian). It has been rumored that in the case of the Austrian ships two turrets will be superposed, but this lacks confirmation (Fig. 5).

Dreadnoughts with six turrets are again comparatively few in number, but present some striking contrasts. The American *Wyoming* and *Arkansas* have twelve 12-inch guns in six center-line turrets, two forward and four abaft of the superstructure. The second turret from forward is superposed, as is also the second from the stern, the object in each case being to increase the volume of fire along the line of the keel. The fourth turret from aft is also superposed above the third, but here the saving of length was the object in view, as these guns do not bear aft. (Fig. 12.)

The only other six-turret *Dreadnoughts* with a 100 per cent broadside are the Argentine ships *Moreno* and *Rivadavia.* These vessels with twelve 12-inch guns have four turrets on the middle line and two *écheloned* (Fig. 13). There has been, and probably will continue to be, much controversy as to which is the more effective arrangement; but the fact remains that the *Wyomings* can cover an arc of 95 degrees on either beam with all twelve guns, while in the case of the Argentine ships this is 10 degrees less. For ten guns the respective figures are 120 degrees and 105 degrees, and for eight 135 degrees and 120 degrees. The Brazilian battleships *Sao Paulo* and *Minas Geraes* have their guns arranged on a similar plan to the Argentine vessels, but the superstructure divides the *écheloned* turrets, which are therefore not available on both broadsides.

For practical purposes the French battleships *Jean Bart, Courbet, France,* and *Paris* are similar to the Brazilian, two turrets being mounted forward and aft (with one superposed in each case), and two abreast amidships. (Fig. 13.)

We now come to a striking variation in design. The German battleships *Rheinland, Posen, Nassau,* and *Westfalen* all have twelve 11-inch guns as their main armament; but they are so disposed in their six turrets that only eight guns bear on the beam. (See Fig. 15.) It was at first thought that this system was due to a misapprehension as to the system of naval tactics which the *Dreadnought* principle involved, but this is hardly borne out by the fact that the arrangement is being strictly adhered to. The *Thüringen, Helgoland, Ostfriesland* and *Oldenburg* are armed with twelve 12.2-inch guns apiece; but the distribution remains the same. Although, therefore, these ships carry as many big guns as the *Wyoming,* the latter is 50 per cent superior on the broadsides. The German vessels, with their twelve guns are no better as line-ahead broadside fighters than the *Michigan,* the British *Invincibles,* or even the 15,500-ton Spanish *Españas*—leaving questions of speed and protection out of consideration.

Curiously enough, the Japanese have also adopted this system, at least for their first two all-big-gun ships, the *Kawachi* and *Settsu,* for the distribution of the 12-inch guns in these ships is the same as that of the 11-inch and 12.2-inch in the German vessels. The average student of the naval war between Japan and Russia will be hard put to it to find any justification for this subordination of the broadside; and it is more difficult to understand since it has been reliably stated that all the data gleaned by the Japanese were placed at the disposal of the British authorities. The same tactical data could hardly justify the *Orion* (Fig. 7) and at the same time excuse the *Kawachi* (Fig. 15.)

Summarizing these details, it will be found that the total number of heavy guns mounted in the 69 ships of the *Dreadnought* era whose details are known is 723, a total that could not have been attained with fewer than 181 ships of the pre-*Dreadnought* era. The ownership of the guns, as well as certain other details, is shown in the following table.

Countries.	Number of ships.	Details known of.	Guns mounted (inches caliber).							
			14-inch.		13.5-inch.		12-inch.		11-inch.	
			Total.	Broadside.	Total.	Broadside.	Total.	Broadside.	Total.	Broadside.
Great Britain	32	27	..	..	104	104	252	238	..	..
United States	12	10	20	20	...	...	100	100	..	..
Germany	21	9	..	..	...	...	48	32	56	40
Italy	4	4	..	..	...	...	51	51	..	..
Russia	4	4	..	..	...	...	48	48	..	..
France	4	4	..	..	...	...	40	49	..	..
Spain	3	3	..	..	...	...	24	24	..	..
Argentine	2	2	..	..	...	...	24	24	..	..
Brazil	3	2	..	..	...	...	24	20	..	..
Japan	7	2	..	..	...	...	24	16	..	..
Austria	4	2	..	..	...	...	24	24	..	..
Turkey	2	0	..	..	...	..	...	...	..	..
Chili	2	0	..	..	...	..	...	...	..	..
Totals	100	69	20		104		543		56	
Number of guns in three-gun turrets			..		...		111		..	
Number of guns in center-line turrets			20		104		407		20	

It will be noted that as the caliber increases so does the desire to place all the guns on the middle line.

THE CATASTROPHE OF THE LIBERTÉ.—The Court of Inquiry will not have completed its investigations before next week. In order to get at the causes of the catastrophe, it is determined to follow up every clue having a practical bearing on the matter and to hear all testimony.

Any attempt at the present time to anticipate the conclusions of the Court would be premature. Such opinions as have so far found their way into print are only hypothetical.

Can the origin of the explosions be placed to the secondary battery magazines with their old-style powder? Is the theory tenable that the fire began in the starboard, forward, 19 centimeter magazines where powder of recent manufacture (AM_8) that is, powder containing 8 per cent of amylite, was stored? Finally, can the hypothesis of criminal malevolence be entertained?

The Court is determined to make these points clear, but the task is not an easy one on account of the discrepancies in the depositions of the survivors. The injured are being examined at the hospital and the uninjured are being taken to the wreck to facilitate their declarations. Since the Court is performing its duty conscientiously we should await its report, especially as the Minister will immediately authorize the carrying out of such measures as it may recommend.

At the request of Rear-Admiral Gaschard, Chairman of the Board, Lieutenant de Rothiacob, the admiral's aide and Lieutenant Le Dô, ord-

nance officer of the *Justice*, who were recorders of the Court of Inquiry, have been appointed members.

On the 7th of October the Cabinet discussed the measures to be adopted after the explosion on the *Liberté*. It was decided to create a board to investigate service powder and to propose measures for the storage, preservation, and the supervision of powder supplies. The Board, composed of some of the most competent specialists, will begin its investigations at once and will make the necessary recommendations.

The order to remove from shipboard as soon as practicable all powder manufactured prior to 1902, which applied originally only to the squadrons, has been extended to apply to the schools, the flotillas, and more generally, to all the ships of the navy.

The Minister of the Navy has decided to suppress the third revision of Article 39 of the orders of October 1, 1908, which is the only regulation affecting the preservation of ammunition on board warships. This clause provided for putting back into the magazine after firing, ammunition that had missed fire, etc. Consequently, it will not be permitted in the future to return to the magazine ammunition that has been placed in a gun for firing purposes.

The Minister has also decided to require at all times and in all circumstances the presence on board battleships and large cruisers of a head of department who shall be responsible for the command of the ship. The regulations will be changed to this effect.

The large crane of the shipyards of La Seyne is being utilized for clearing the wreck of the *Liberté*. The wreck of the *Liberté* has been put in charge of the station at Toulon. Commander Baucheron de Boissoudy is in charge of the investigation and the salvage. He has under his orders gangs of workmen belonging to the construction corps, the ordnance department, and other branches of the service. Various effects belonging to the personnel of the *Liberté* have been found in the wreckage.

The roadstead being scattered with débris, divers from the various ships have been exploring its bottom and the dangerous spots have been marked by buoys.

It will take two months and a half to repair the damages done the *République*. The 37-ton armor plate was crushed in on the starboard quarter behind the 30 centimeter turret. In the very same spot, and almost at the same time, a melinite shell from the *Liberté* exploded. The explosion of this projectile undoubtedly explains the breach made in the armored deck. The base of the projectile was found on the deck and the matériel, clothing, etc., which were struck by the shell, show the usual shattering caused by melinite. A curious fact was the unscrewing and dislodgement of the 65 millimeter T. R. gun from its mount between decks on the starboard quarter.

Toulon is beginning to recover its normal aspect. Our private correspondents state that the morale of the officers and crews has not been affected.

Now that everyone has recovered from the stupefaction of the first moments and the funeral rites have been tendered the victims, work has been renewed with the same spirit as before the catastrophe.

The muster-roll of the *Liberté* will be closed on the 20th of October.

As far as possible, all the records destroyed in the explosion are to be restored, such as the liberty lists, muster-rolls, enlistment records, pay-rolls, conduct books, etc. In addition, declarations of the loss of effects have to be taken, indemnities to be paid, the families of the victims to be relieved, etc.

After the explosion of the *Iéna*, many months were required to complete this work, and there are no prospects of a speedier settlement in the case of the *Liberté*.

An authoritative list of the missing has not yet been drawn up for the following reasons: The muster-rolls of the *Liberté* went down with the

ship and the accounts kept at Brest, a pay station, did not show the most recent transfers. A report of transfers was to have been furnished aboard ship on the very day of the castastrophe. Consequently it has not been possible to draw up an accurate liberty list.

Since the catastrophe of the *Liberté*, a notable increase in the voluntary enlistments has been recorded. Finistére in particular, has furnished a large number of young recruits.

MARINE ENGINEERING.

THERMIT. Edited by R. H. D.—The use of "Thermit" for emergency repairs in marine service is rapidly increasing. Among the examples of work recently done by this means are included the repair of the port propeller shaft, 10-inches diameter, of the U. S. Engineers Dredge *Galveston*, at Galveston, Texas: The welding of an 8-inch crank shaft for an Aldrich pump, which was accomplished in three days, using 215 pounds of Thermite: The welding of the main shaft of the steamer *Manhanset*, which was out of commission but eight days for this repair: The repair of the stern-post of the steamer *Moses Taylor*, at Cleveland, Ohio, which was completed between the afternoon of August 19 and the morning of August 23. This break was 8½ x 12 inches in section, and about 725 pounds of metal were used in making the repair. The welding of the rudder stock for one of the large lake passenger steamers, 12-inches diameter, was successfully accomplished in a very short time after docking.

An interesting repair was recently accomplished in Germany, of a somewhat different type from those above: A large horizontal suction gas engine had broken the outboard jaw of one of its main bearing sockets by back firing; a new jaw of cast steel was cast on to the cast iron frame, without dismantling the engine in any way except to remove the shaft and bearing boxes; this required the use of about 550 pounds of metal and was thoroughly successful, as well, of course, as being much more economical and requiring much shorter time than any other method of repair.

The torpedo tender *Dixie* has used Thermit with success on a number of repairs of various types, and is continuing its use where the work is of a suitable nature.

THE ADMIRALTY AND NAVAL ENGINEERING.—Now that the cadets who entered the naval service under the "common entry and training system" introduced in 1902 are about to attain official rank in the fleet, the Admiralty have issued additional instructions regarding the preliminary work of these sub-lieutenants and the apportionment of officers to special duties in the engineering, gunnery, torpedo, navigation, and marine departments. These instructions, we may say at the outset, do not allay our anxiety, expressed time and again during the past seven years, as to the adequacy of the practical course of engineering embraced in the scheme of training for the specialized duties which develop upon the engineers who have to deal with the extreme complications now common in warships. Resisting the temptation to enter once more upon the subject, upon which nearly all engineers are agreed, we content ourselves here with a consideration of the course now mapped out by the Admiralty for the immediate future.

For the next two years the embryo officer, irrespective of his ultimate function and position in the *personnel* of a ship, will serve afloat. During that period three weeks in every quarter will be served in the engine-room in the discharge of the ordinary duties of a junior engineer officer. For the officer whose later work is to be on the bridge, or on deck, this may suffice, especially as during the past nine years such officers have been devoting a considerable time to study of, and observational instruction in, various mechanical subjects. But for the officer who is, by choice,

or by Admiralty selection, to be responsible for work in the engineering department of the ship in later years, the time stipulated is inadequate. It would seem from the amounts of time devoted to the various subjects that those in authority regard the relative value of the machinery in a warship at 23 per cent of the entire structure. This is so obviously a depreciation of the importance of speed in tactics, to say nothing of other matters in which efficient engineering skill is all-important, that little argument is necessary to prove its fallacy. It is true that, as we shall presently explain, lieutenants selected for engineering duty will undergo a further specialized training; but in this two years' early course there will be consolidated that feeling, which has been suggested for nine years to the mind of young officers, that engineering is of secondary or tertiary importance, and unworthy of permanent acceptance as the subject of a life's work. That, indeed, is one of the strong reasons against the common entry and training scheme. Under it engineering has become a series of little by-paths on the climb up the hill of success in naval life; these are frequented by youths, at the command of the curriculum, for a short period, the main road to the admiral's bridge being always the dominant objective. A youth has always difficulty in concentrating effort until he is certain that he is working towards a definite goal. Indecision as to the ultimate destination breeds indifference.

One year after attaining the rank of sub-lieutenant—a year hence—choice may be made of one or other of the branches of the service; but a definite confirmation, or compulsory selection, will not be made until two years from now. Each officer is to indicate his first preference, giving also his alternatives in order. The authorities will fill up the requirements of each branch, and it may—we should say it certainly will—result that many officers will be appointed to branches, especially to engineering, who have no great ambition in that direction. Time will tell; so that we need not discuss this question, nor enforce the view that the making of a man an engineer against his desires cannot conduce to efficiency in the service. When nominated a lieutenant (E.) he is to attend special engineering classes at Greenwich College for six months. The engineering course at Greenwich has done wonders for the present engineers, but it must not be forgotten that they laid a splendid foundation in their previous training, in which practical work formed a most important part. Following the Greenwich course, a year is to be spent in practical work in one of the dockyards. If successful in examination at the end of this period, the lieutenant (E.) will go into the service as a junior engineering officer afloat, getting 4s. per day. He will be a member of the Military branch, conform to its regulations, and obtain promotion accordingly, his pay as commander becoming 5s. per day.

A few officers will be selected from the lieutenants (E.) to undergo a two years' course of scientific training at Greenwich College and a year at sea in order to provide a flow of engineering officials at the Admiralty and dockyards. Upon proving their ability by examination they become specialists, and will be designated by E.† after their rank. These specialists will be paid 5s. per day as lieutenants, 7s. as commanders, and 7s. as captains plus 5s. as command money. In this case, as with ordinary officers (E.), charge pay, senior engineers' allowance and flag allowance will be paid as at present. The specialists will serve in ships if no shore appointment is available. Captains (E.†) may be promoted to flag rank, but will not take command of sea-going ships or fleets.

These specialists, as well as the ordinary officers (E.), may, on passing the examination for commander, leave the engineering branch of the service and take up deck duties. Here, as throughout the whole system, there is displayed a complete lack of appreciation of the importance of ripe practical experience in the engine-room. It is notorious that in the past the "loaves and fishes" have gone to the military officer. The Admiralty have encouraged this by the abundance of distinctions, decorations,

and other honors conferred on the military officer, and by the neglect of the engineer when such recognition was made for faithful service. When distinguished visitors are received the engineer is forgotten; this is a small affair, but it is not without its effects. There are, too, many allowances to the navigating and bridge officers in pilotage money, etc., which materially increase their emoluments. And, finally, there is the higher rank, and the possibility of winning glory in the command of a ship or a fleet. These superior inducements of the military branch will be ever present to the engineering officer, especially if he has been forced to enter the department at the outset of his career as an officer afloat. His ambitious eye will, therefore, always be on the bridge, and thus it will eventuate that the engine-room will be for him "no continuing city," and he will be reconciled to his immediate surroundings only by the probability that service in the engine-room efficiently done will count in the promotion to that sphere which is higher, according to the world's opinion of the deck branch.

The advancement of the most efficient lieutenants (E.) or lieutenants (E.†) to commanders in the military branch will so seriously affect the machinery department as to be disastrous for the service. One has only to reflect upon the great advance in marine, and especially naval, engineering during the past ten years to realize the enormous value of practical experience, as well as wider scientific knowledge, if the best is to be achieved from these improvements, and particularly if probabilities of breakdowns are to be anticipated on the spot. If, then, upon winning experience, men are to be permitted to desert the engine-room and to deplete the staff of its best officers, grave results must follow. The engineering profession is as honorable and as worthy of recognition as any other—fuller of interest than even the military branch of the navy—and upon it depends the success of the fleet in peace and in war. "The man behind the man behind the gun" can win or lose actions, and once an engineer always an engineer should be the rule. We can see no justification for this practice of first training officers as engineers and, when they are in the position to apply experience, to allow them to pass to another branch of the service, where their special experience is inapplicable or of little avail. The idea is contrary to all the tenets of a successful commercial nation. If the engineering work is not as popular as the military branch, the remedy lies with the authorities, and we have indicated some directions in which the disparity may be lessened if not removed. The first step should be one to equalize the conditions of the present engineering officers with the present military officers.

We are encouraged in the hope that the Admiralty will yet see their way to prevent this desertion of the engineering branch by the amendments they are now introducing in the case of marine officers. Here the intention was to make the marine not only co-equal with the others, but to permit the officers to pass at a certain stage of their career into the general naval service. This is changed. A lieutenant (R.M.) will, as a rule, remain attached to his corps throughout his career, gaining promotion as in the military branch. Only in certain cases can he pass to the military branch, and then solely at a later period in his service. Since this breach in the scheme has been made, there is hope that it will soon be applied to the engineering branch; the sooner the better for the navy. Moreover, when it appears as if there would be a certainty of a paucity of volunteers for the marine branch, a certain number of applicants are to be received into the branch without passing through Osborne and Dartmouth, a special course being provided for such. Here the principal of common entry and training is departed from. We do not blame the authorities. To profit by the teaching of experience is, on the contrary, praiseworthy. We hope the profit will yet extend to the engineering branch—*Engineering*.

ELECTRIC DRIVES FOR SCREW PROPELLERS.* By H. A. Mavor.—The problems of marine engineering have until recent years been solved exclusively by the application of various forms of the reciprocating steam engine, and the power, speed, form, and general arrangement of power-driven vessels have been developed in connection with this means of propulsion. The advent of other appliances has opened up new lines of development, and in certain departments there is evidence of need for intermediate devices between the power-producing and the power-absorbing elements.

The necessity for these devices arises when the properties of the propeller in respect of rate of revolution are incompatible with those of the power-generator. This incompatibility is most conspicuous in vessels which have to operate at relatively slow speeds. An examination of the conditions which have emerged in the development of marine propulsion soon shows that the incompatibility is not accidental, or due to imperfections in the design, construction, or use of the propelling equipment, but that it is associated with the essential properties of the substances and appliances with which we have to deal.

It may be said in general terms that high efficiency is associated with low rate of revolution of the propeller, while in the steam-turbine high rates of revolution are essential to the most economical use of the steam. Internal-combustion engines have speeds more nearly approximating those of reciprocating steam-engines, but here also there is a tendency to speeds higher than are convenient or economical from the propeller standpoint.

In addition to those fundamental incompatibilities arising from causes out of the reach of direct accommodation, there are other conditions which limit the direct application of engine to propeller. The draft, beam, and form of the vessel limit the area of the propeller. The traffic for which the vessel is designed influences the determination whether one, two, or more propellers are to be used, and the speed, size, and form of the vessel determine limits to the designer's choice. All these considerations taken together frequently fix the diameter, pitch and thrust of the propeller, and within very narrow limits, also the rate of revolution. Now this rate of revolution is not always the most favorable for the power-generator, and the designer is in such cases compelled to resort to new expedients if he is to attain the standard of efficiency in power generation which has been set by the results attained on land. At the present moment the economy of power production in the best practice on land is considerably in advance of what has been done at sea. The principal reason for the better economy of the land work is the higher rate of revolution of the power-generator when untrammeled by propeller conditions. There are cases where the special limitations in respect of dimensions and weights permissable for the machinery are such as to preclude the use of any intermediate mechanism between the prime mover and the propeller.

In a ship whose voyage is short, whose speed is high, displacement small, and the propeller efficiency as good as is attainable, and the quantity of fuel carried small relative to the weight of machinery, the possible economy in fuel may be insufficient to warrant any increase in the weight of machinery; or, to put the case otherwise, it is advisable to sacrifice economy in fuel to keep down the weight of the equipment—*e. g.*, a vessel running one-day voyages, and burning 50 tons of coal, could not possibly submit to an increase in weight of machinery in excess of the coal-saving, because such increase would increase the displacement and the power necessary to drive the vessel. If, on the other hand, the vessel makes a 10-day voyage, and the saving in fuel carried amount to 10 tons per day, a considerable increase in weight of machinery might be associated with decreased displacement and a substantial all-around economy.

* Paper read before Section G of the British Association at Portsmouth, September 1.

Various methods of making the required adaptation of generator to propeller are at present under trial. For this mechanical gearing by toothed wheels or hydraulic transmission may be considered serious competitors with electric transmission, but for large powers it seems reasonable to expect that electric transmission, which is already developed for this very purpose on land, is likely to find an equally useful field where the conditions are such as to require an intermediate device at sea.

The cost, weight, and efficiency of electric transmission compare favorably in the examples which have been examined with either of the two competing methods. There are other important qualifications of electric transmission in which it stands altogether unrivaled. The most important of these qualifications are: It provides a ready means of reversing the direction of rotation of the propeller without changing the direction of rotation of the power-generator.

The electric transmission also provides means for changing the speed ratio between generator and propeller, so as to permit of the power of the generator being developed under the most favorable conditions at all speeds of the ship.

Lastly, it provides means for applying the power of one or more engines to one or more propellers, so that the power-generating units may be so disposed as to give the highest efficiency, and when they are not required they can be stopped. These properties of the electric transmission supply exactly what is required to render steam-turbines, and also internal-combustion engines, completely adaptable to the purpose required. Both types of power-generators give their best efficiency when full speed of rotation is maintained, even when running below full power. It is, therefore, advantageous to keep the engine revolutions within the range of governor control, while the required speed change is accomplished by electric combinations.

The properties of the electric motor lend themselves well to the requirements of maneuvering. The rate of reversal is under perfect control. The possibilities of rapid and certain action are more than attainable in a reciprocating steam-engine connected direct to the propeller, and the electric motor is applicable to powers for which there is no possibility of using anything in the nature of reversing gears or clutches.

The property of combining the power of more than one engine for application to one or more propellers is the special feature of the author's inventions as distinguished from the ordinary methods of electrical engineering. Engines of different types, sizes, and rates of revolution can have their powers combined without interconnection of their electric circuits, and without risk of mistake or error. An oil-engine at 100 revolutions may be running the vessel at slow speed, and a steam-turbine running at twenty times the speed may be jointly applied to the propellers without any complication of the electric equipment. Each unit does its own work independently.

The advantage of such an equipment in vessels which are required to operate under varying load conditions is evident. Without subdivision of the power units the whole of the main machinery must be in motion while the ship is in motion. At speeds reduced below its normal rate of revolution the steam-turbine is even less economical than the steam-engine. Subdivision into high-pressure, low-pressure and intermediate elements has been carried out in certain steam equipments, but this result in a somewhat complicated and inconvenient system of piping, because the steam has to be led from one part of the system to the other across the vessel. In the electric system each unit can be self contained, and disposed in the manner best suited to a convenient arrangement of the engine-room. The size of the individual units can be adjusted to suit the powers required at the different working speeds, or they may be duplicate.

A few examples of application of the system are here presented, together with a description of a small vessel built to demonstrate and illustrate the principles of operation and to provide experience in the use of the plant. In all cases alternating 3-phase currents are used, and interlocking devices connect mechanically the main reversing switches with the existing switches, so that no change can take place in the connections while they are passing currents.

Description of the Turbo-Electric Steamship "Frieda," for American Owners.—This vessel has been specially designed for the transport of bulk freights between the Gulf of Mexico and New York City. The vessel is to be 300 feet long, and will carry a dead weight of approximately 5000 tons, at a mean loaded speed of twelve knots at sea. The propelling machinery is aft, and consists of a turbo-electric outfit for 1500 kw. three-phase 50 cycles when running at 3000 revolutions per minute. The turbine is supplied with steam at a pressure of 200 pounds per square inch at the turbine stop-valve. This electric generating plant is arranged on foundations on a platform deck in the engine-room, and the condensing plant in the engine-room hold. The condenser is fitted with a vacuum augmenter, and is suitable for dealing with the full-load quantity of steam from the turbine. The vacuum obtained will be 28½-inches, with cooling water about 85 degrees Fahrenheit. This condensing plant consists of a vacuum condenser, three-throw air-pumps, and a centrifugal circulating pump with electric-motor drives. The current is led to a three-phase motor, which is keyed direct to the main propeller shaft, and is capable of developing 1900 brake horse-power at a speed of about 84 revolutions per minute. The steam is generated in two Scotch boilers, with Howden's forced draft, and liquid-fuel burners. This installation costs and weighs less than the normal equipment. The coal saving is over 10 tons per day. The design of the ship itself presents many other novel features. This design was prepared by Messrs. John Reid & Co., 17 Battery Place, New York City.

Oil-Electric Tank-Barge for Canadian Service.—In this the system is applied to the propulsion of a 245-foot Canadian canal-type tank-barge for the Standard Oil Company of New York. The equipment consists of three separate units of Diesel non-reversible oil-engines, each capable of developing 200 shaft horse-power, each directly connected to an alternating-current generator. The currents from one or all of the units are led to the separate windings of a three-phase motor, keyed to the main propelling shaft, and operating a single slow-turning screw. The great advantage and economy of this system consists in being able to run at full power or at one-third power using one or three engines at full-load economy at will, thus providing for an economical operation impossible with any other propulsive system. The fact that non-reversible oil-engines are used running under governor control greatly simplifies the maintenance and operation. The control is operated by a low-tension interlocking switch, operated by an ordinary engine-room telegraph-stand located in the pilot-house, so that the maneuvering of the vessel is at all times in the hands of the navigating officer. This equipment increases the cost of the ship about 10 per cent above the normal, but the carrying capacity is very largely increased.

Marine Turbo-Electric Installation Proposed for United States Navy Colliers.—A marine turbo-electric installation has been submitted to the United States Navy Department for adoption in one of the four large colliers recently given out to contract. The installation consists of a steam turbo-alternator of 5000 kw., with condensing plant; the current is led to two motors, one being keyed to each propeller shaft. The machinery is right aft in the vessel. The steam is generated by Scotch boilers. The vessels in which it is proposed to install this machinery are 525 feet long, and will carry a dead-weight of 12,500 tons of coal at a speed of 16 knots

at sea. Here, again, the cost, weight, and economy are better than can be shown with the normal reciprocating-engine equipment.

In the course of a summary of the principal points involved in electrical propulsion, Mr. Hobart remarks that a study of the circumstances reveals a remarkable accordance of means and requirements. "It has come to be recognized that a very important advantage of the electric drive as applied to ship propulsion, relates to the independence which it provides between the prime movers and the propellers, for instance, a triple-screw ship no longer requires to have just three engines. Four engines, or two, or some other number, may be more suitable. If four engines are employed, while only one may be required to be in service at cruising speed, nevertheless each of the three propellers will be driven by its own electric motor or motors. Thus it may readily be arranged that whatever machinery is in operation shall be carrying its most economical load. Appreciation of the importance of this feature (which is exclusive to the electric drive and is not provided by any of the mechanical speed-reduction methods) has caused engineers to consider with increased interest the merits of the internal-combustion engine as a prime mover for ship propulsion, and it is seen (when employed in connection with the electric drive) to be a very promising alternative to the turbo-electric drive."

"It would appear that the addition of the electric drive will save the situation for the steam turbine, and also for the internal-combustion engine, so far as relates to their application to ship propulsion. In addition to the attributes already mentioned, the electric drive at once provides for astern running without any of the complications, difficulties, and expense otherwise encountered in connection with astern running when the prime movers are other than reciprocating steam engines. One of the most notable features of the electric drive relates to the greater precision afforded during stopping or quickly reversing or sharply altering the course of the ship. In these operations, no other means can approach the power and precision inherent to the electric drive."

Mr. Hobart further remarks that the British Admiralty stands alone in the adoption of the policy of equipping all battleships and cruisers with steam-turbines. "In the German Navy and in the American Navy, steam-turbines have been employed to only a very limited extent, and, so far as relates to battleships and cruisers, appear to be regarded as inherently inferior to the piston engine for the purposes of marine propulsion. The inclusion of the feature of the electric drive will eliminate from the steam turbine proposition the inherent disadvantages which otherwise attend its use, and, in large sizes, will place it in the same position of unchallenged superiority over the reciprocating steam engine which it already occupies in land practice."

"For constant speed operation, the mechanical methods which are now being successfully exploited by Westinghouse, Parsons and Föttinger, are admirable. But for astern running, the last mentioned alone shares with electrical systems the advantage of dispensing with the necessity of reversing the prime mover, and (in the case of steam turbines) of providing auxiliary prime movers. None of these three systems comprise any feature endowing them with any such perfection of control in maneuvering or in prompt stopping, as can be provided by the electrical method. Moreover, it should not be overlooked that *all* ships are, on occasions, required, as when in crowded harbors and during foggy weather to proceed at other than their normal speed. The mechanical systems cannot approach the electrical system in the matter of economy at other than maximum speed, and the superiority of the electrical system is very considerable for ships

which must frequently proceed at speeds much below their maximum speed. For strictly constant-speed ships, a good case can, however, be made out for the use of mechanical gearing, as it should usually show higher efficiency and lower first cost than the equivalent in electrical machinery. As already mentioned, however, the mechanical method is at a disadvantage in requiring auxiliary turbines for reversing, and in affording a less powerful and exact command of the boat in all maneuvering operations."

In the volume referred to will be found a very instructive account of the Melville-Macalpine Föttinger and other mechanical speed-reduction gearing, chapters on the use of superheated steam in marine engines, electrical gear as a means for improving the load factor, internal-combustion engines for ship propulsion, etc. The chief credit for recognizing, in its wide bearings, the load-factor advantages associated with the electrical propulsion is assigned by the author to Mr. Henry A. Mavor, who has for several years devoted a large amount of study and investigation to the application of electricity to ship propulsion. Mr. Mavor's proposals are examined in great detail together with those of Mr. William P. Durtnall, W. L. R. Emmet, and others, including the Mirrlees-Day system. It is essentially a work which should not be missed by anyone desirous of following up this important development of the practical side. Unless we are very much mistaken it is a work which marine engineers have been literally waiting for, and armed with the data now provided they should be enabled to return to the complicated problems involved with renewed ardor.—*Pages Weekly.*

MOTOR-DRIVEN WARSHIPS.—Some time ago, when considerable discussion was going on regarding a supposed motor battleship which was "to appear shortly," but has not yet been heard of, we pointed out that it would be a departure from all precedent if the Admiralty installed an experimental set of marine engines in so large a vessel as a battleship; and that it was much more likely that we should have a motor-driven torpedo craft as an experimental ship. Our prophecy has turned out to be true, for we now have it on good authority that Messrs. John I. Thorneycroft, of Southampton, are building a destroyer for the Admiralty which is to be driven by a Diesel oil engine, in lieu of cruising steam turbines. As we mentioned in the *United Service Gazette* last week, a two-cycle Diesel engine of, it is said, 6000 horse-power is being made by Messrs. Vickers for their Lordships, which is to be installed, for experimental purposes, in a twin-screw cruiser of the old type, displacing one of the steam engines and working side by side with the other. It is fitting that Messrs. Vickers should be given the larger job, since the success of the only motor-driven vessels of any size in the British war-fleet, the submarines, has been beyond question, and they have been built solely by this large company, aided during the late years by the Royal dockyard at Chatham. Vickers, by-the-way, are adding large administrative and other offices to their already huge premises, and the development of the marine motor is receiving close attention from this enterprising firm.—*United Service Gazette.*

The trend of engineering progress is shown from an exceedingly broad and withal unbiased viewpoint, in the recent report of the chief engineer of the British Engine, Boiler and Electrical Insurance Co. on breakdowns of various types of machinery insured by them.

The commercial engineer presumably knows all about the weaknesses of his own designs, and to a certain extent he is cognizant of the failures of other designers in his own field, but there his information usually stops short. However, an insurance company being in a sense a disinterested party, in that he has no interest in the competition between designers, and on the other hand being the first party to be informed of

failures in the apparatus covered by its policies, is in a peculiarly favorable position to obtain much information of great general interest to the engineering profession at large.

The above-mentioned report shows the marked progress in gas engine development. The statistics given indicate that out of every forty-five engines now insured, 20 are gas engines. The figures also show that 1 out of every 9.7 steam engines insured had some sort of failure during the year, while only 1 in 10.8 of the gas engines was similarly reported. These figures are, however, doubtless rather misleading, as the steam engines will in the majority of cases be shown to be considerably older than the gas engines and so a large number of the steam-engine breakdowns may be charged to worn out parts instead of faulty construction or defective material, which are the most fruitful causes of trouble in the gas engines. This is shown conclusively in the appended summary table in which the causes of trouble are roughly classified:

	Steam Engines.	Gas Engines.
Accidents and other undetermined causes.....	37%	35%
Old defects, wear and tear, etc.....	34%	29%
Weaknesses, bad workmanship, poor design or material	16%	19%
Negligence of owners or attendants.....	13%	17%

Commenting on the table above, the report says that while the proportion of failures to the whole number of engines insured is gradually decreasing, there is an increasing number of failures which are due to breakage of small parts, valves, gearing, etc., which seems to show are of two things: either the larger, more important parts are being more carefully designed, strains being figured from theoretical considerations and the problems of design being more thoroughly analyzed instead of being decided by rule of thumb in comparison with the smaller parts, which are, more frequently than not, merely made to "look right;" or on the other hand, the general design may be changing in such a way as to make more small parts which are susceptible to failure in one manner or another. It is quite presumable that a combination of these two factors may be the real explanation of the change noted in the character of the failures recorded.

The number of boilers insured is gradually decreasing, due no doubt in part to the increase in the number of gas engines, but also to the increase in size of units. Inasmuch, however, as a large proportion of the boilers insured are of low pressure types, the boiler information is of little interest to marine engineers.

The tendency toward the use of alternating current apparatus for shore work is shown by the increase in number of alternate current machines insured, which now number 14.5% of the total insured.

Two causes of trouble are especially mentioned and warned against —one is the practice of leaving exposed cable ends on uncompleted work, which may become grounded and throw heavy overloads on the machines. The other is the practice of coupling up the leads on enclosed or semi-enclosed apparatus with so-called dry joints, *i. e.*, joints without solder. The insurance company finds that the resistance caused by such joints frequently overheats the wires and sets fire to the insulation, which of course very promptly causes much more serious trouble.

NOTES ON OIL ENGINES. Edited by G. J. M.—The oil engine in its present state of development is of several types. It has, however, been brought into prominence by the success of the Diesel engine, and consequently it is of interest to know why this type of engine has been successful.

The alteration of the design of the gasolene engine represents one type of the heavy oil engine. The alteration was made to utilize the crude oils, and the oils that are by-products of refining and that have no commercial use except as fuel, and consequently are comparatively cheap, ranging in price from two to five cents per gallon depending on the locality and transportation facilities.

The preparations of these heavier hydrocarbons for use in the engine consists essentially of vaporization and mixing. In one case, figure 1, this is effected during the compression stroke. The oil is injected into an incandescent hood or chamber, which for starting is heated up externally by means of a lamp, and afterwards kept hot by the combustion of the mixture in it. During the compression stroke, air from the cylinders rushes through the contracted opening into this chamber and mixes with

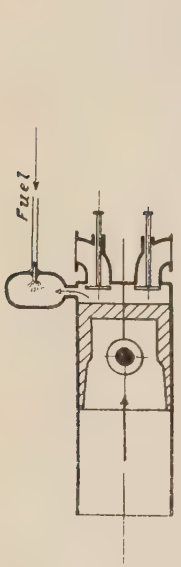


FIG. 1.

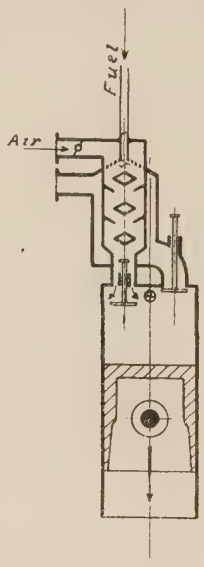


FIG. 2.

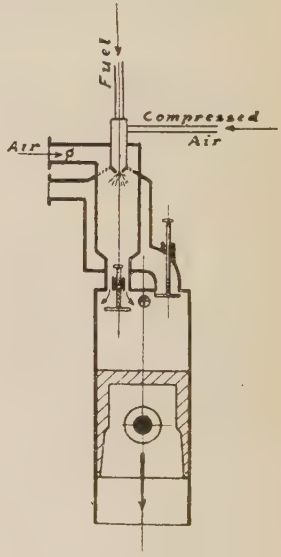


FIG. 3.

the vapors therein, until the end of the stroke, the right proportion of combustible to air is reached. The mixture is then ignited simply by direct contact with the hot walls of this vaporizing chamber, augmented slightly by the heat due to compression.

Another is shown in figure 2. The vaporizer chamber is provided with a jacket space through which the exhaust gases pass, thus heating the vaporizer externally. A cloud of fuel vapor is produced by dropping the liquid fuel on the heated surfaces of the baffle plates inside the vaporizer. On the suction stroke of the piston, free air enters this vaporizer and, in passing over the baffle plates, becomes heated and in the same time absorbs the oil vapors; the mixture thus formed and pre-heated then enters the cylinder and at the end of the compression stroke is ignited by the electric igniter.

A third case is shown in figure 3. The fuel oil is mixed with and broken up by a stream of compressed air of from 8-25 pounds pressure above the atmosphere, so that it enters the vaporizer chamber in the form of finely divided spray, and is immediately vaporized, due to the heat

applied externally by the exhaust gas. The bulk of the air, being aspirated during the suction stroke, then mixes with the fuel vapor and becomes pre-heated, thus forming the explosive charge. Compression and ignition are the same as in figure 2.

These types of oil engines, especially those of figures 1 and 2, are quite simple and therefore cheap in first cost. Their method of vaporization, however, is rather crude and gives rise to objections well borne out by practical experience, which are the cause of the prevailing prejudice against such oil engines. The chief drawback to all these vaporizers is the practical impossibility of vaporizing the fuel completely at all loads and under all conditions. The heat of the chamber should always be high enough to vaporize all the oil, but never hot enough to decompose it, or a deposit of carbon will be formed in the vaporizer and cylinder, accompanied by incomplete combustion and therefore low efficiencies; this manifests itself by the objectionable smoke and odor of the exhaust gases. Another drawback is that in all engines of the type of figure 1, in order to obtain certainty of ignition and at the same time prevent pre-ignitions at different loads, the temperature of the vaporizer should vary with the load, a practical impossibility. The pre-heating of the mixture, as required for engines operating under the principles shown in figures 2 and 3, decreases the weight of the air aspirated, and therefore the capacity of the engine; while the throttling of the air in passing through the vaporizer chamber and passages, as well as the high back pressure due to the exhaust gases passing through the jacket space of the vaporizers, decreases the power output of such engines still more. The necessity of first heating the vaporizer externally by means of a lamp before the engine can be started is rather inconvenient as it takes at least five to ten minutes. The fuel consumption of these engines averages about 1 pound of oil per b. horse-power hour, corresponding to a thermal efficiency of not over 15 per cent.

These three types cover in a general way the mechanical principles of some of the commercial liquid fuel engines today on the market. A great variety of modifications is possible, but they all have in common the fact that the fuel and air mixture after having being compressed, is instantaneously ignited; that is, at constant volume, and according to this mode of heat application they belong in the class of constant-volume engines. The degree of compression is limited with the thermodynamic cycle on account of the danger of premature ignitions due to the compression temperature, and hence the efficiency is limited. Without artificial means (which have been found to be impracticable) the safe limit of compression in the present constant-volume oil engines has by long experience been found to be about 60 pounds in kerosene engines, with spontaneous ignition. The efficiency of these types of engines is not likely therefore, to be increased in the near future beyond about 15 per cent. Considering this, as well as the undesirable features touched upon before, it is quite obvious that as far as reliability and economy of operation are concerned, these engines fall far short of what may be reasonably expected.

The Diesel type of engine was invented with a view to overcoming these difficulties. The inventor instead of constructing an engine and deducing a theory from it, laid down the working principles which might govern any improvement in the oil engine, and then proceeded to put them in practice. These principles may be stated as follows:

1. Production of the highest temperature of the cycle, not by and during combustion, but entirely by mechanical compression of air.

2. Gradual introduction of a small and well regulated quantity of finely divided combustible into the highly compressed and heated air, in such a way that no further increase of temperature takes place but all the heat generated is carried off by the expansion of the gases of combustion during the working stroke.

3. Introduction of a large quantity of air in excess, instead of admitting only as much air as is required for the combustion of the fuel.

Many refinements and improvements have been made since the first engine was built. Instead of the single stage air compressor direct connected to the engine, such as was used in the first engines, the present practice is to use a separate two- or three-stage compressor either belted to the engine or driven by a motor. The first stage of the compressor delivers air at 75 to 150 pounds and this is stored in steel accumulators. The second or second and third stages compress the air to 900 to 1000 pounds and it is then stored in accumulators and used for spraying the fuel in the cylinder.

The operation of the present Diesel engine is as follows:

Air is drawn into the cylinder during the suction stroke, and compressed during the compression stroke to 500 to 800 pounds per square inch. The temperature of this air due to compression is from 1000° to 1200° F. At the end of the compression stroke, the fuel is introduced in the form of a spray by the combined action of the fuel pump and the high pressure air. The fuel does not explode, but burns, simply because of the heat of the compressed air, there being no other means of ignition. Since the oil particles are burned immediately after their admixture with the air, there is no possibility of deposits forming on the cylinder walls and combustion is so complete that the exhaust products are entirely smokeless and without odor. The fuel pump continues to introduce the fuel during one-tenth to one-eighth of the working stroke, with the result that the pressure in the cylinder during this part of the stroke is constant. Hence the term constant-pressure engine applied to this type. Governing is obtained by regulating the amount of fuel fed into the cylinder by the oil pump. Numerous tests made on Diesel engines of different sizes show an average fuel consumption of less than 0.5 pound of oil per b. horse-power hour, corresponding to a thermal efficiency of about 30 per cent.

To the particular feature of compressing air alone to such a pressure and temperature that it will immediately vaporize and ignite the fuel injected into it, the constant-pressure engine as embodied in the Diesel type undoubtedly owes its success. It lends itself admirably to the utilization of liquid fuels, as it does away at once with carburetors or vaporizers and igniters; moreover it allows the burning of any liquid fuel without special accessories. Another point of equal importance is the fact that with decreasing loads the efficiency of the constant-pressure engine decreases but very little, while that of the constant-volume engine drops very rapidly with lighter loads.

In view of these points, therefore, there can hardly be any question that for the utilization of liquid fuels the constant-pressure engine is far superior to the constant-volume engine.

In a Diesel engine, figure 4 represents the period where a measured quantity of fuel, according to the load on the engine, is being deposited in space *s* of the injection valve cage *c* by the oil pump *o*, the injection valve *n* being closed at that moment. Space *s* is continuously in communication with the air storage tank *t*, into which the 2-stage air compressor *a* delivers the air required for fuel injection at a pressure of from 750 to 1000 pounds. (One or two additional tanks are automatically kept charged by the compressor with air of about the same pressure for starting the engine.) The oil must therefore be delivered into space *s* against this high pressure which, in view of the small quantity to be delivered, requires extremely accurate work and adjustments on the oil pump *o*. Since fuel and injection air come into contact with each other while injection valve *n* is still closed, that is, before the actual injection period, it is quite obvious that the valve cage *c*, as well as the injection air, must be well cooled in order to prevent dangerous premature ignitions or the formation of deposits due to partial evaporation of the deposited fuel.

Figure 5 shows the actual injection period, which starts as soon as injection valve *n* opens; the latter therefore controls simultaneously the admission of fuel and the injection of air into the cylinder. At all loads the points of opening and closing of the injection valve *n* remain unchanged, that is, the length of the period the injection valve is open is constant. Within this period a variable quantity of fuel, according to the load, is to be injected. In order to accomplish this most satisfactorily it has been found necessary to increase the pressure of the injection air with increasing loads on the engine, that is, with increasing amounts

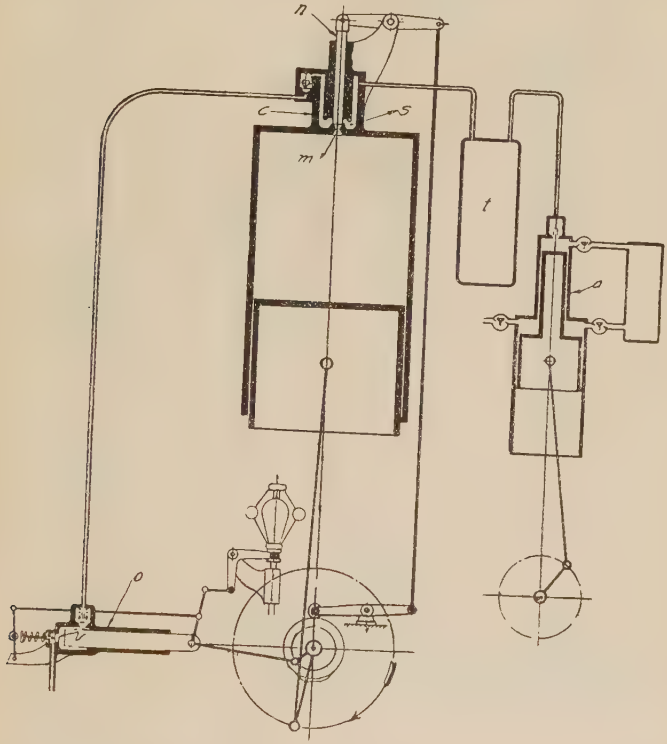


FIG. 4.

of fuel to be injected. This pressure increase is about 250 pounds from light to maximum load, no arrangement having so far been made whereby this pressure can be automatically controlled; this must be done by hand at the judgment of the engine operator.

Some of the variations of the constant-pressure type of engine are the Sabathé engine which is evidently an attempt to eliminate the rather inconvenient requirement of variable injection air pressures with varying loads; the De La Vergne engine which is a combination of the Diesel principle and the hot bulb type as shown in figure 1; the Trinkler-Körting engine; the Haselwander engine; the Atlas engine of the Diesel type; and the Covington engine of the same type.

Probably the latest of the Diesel type of engine is the Setz engine. The principle of air injection is as follows: the injection air is generated right in the engine at the moment the fuel injection is to take place. Figure 6 represents the injection period. The auxiliary piston *t* has just produced injection air of sufficiently high pressure to obtain the desired velocity through passage *k*, from whence it is directed into space *s* in such a way as to cause it to circle around its wall down towards nozzle *m*. At this moment pump *o* begins gradually to force the desired quantity of oil into space *s* at a velocity determined by the tension on spring *g*

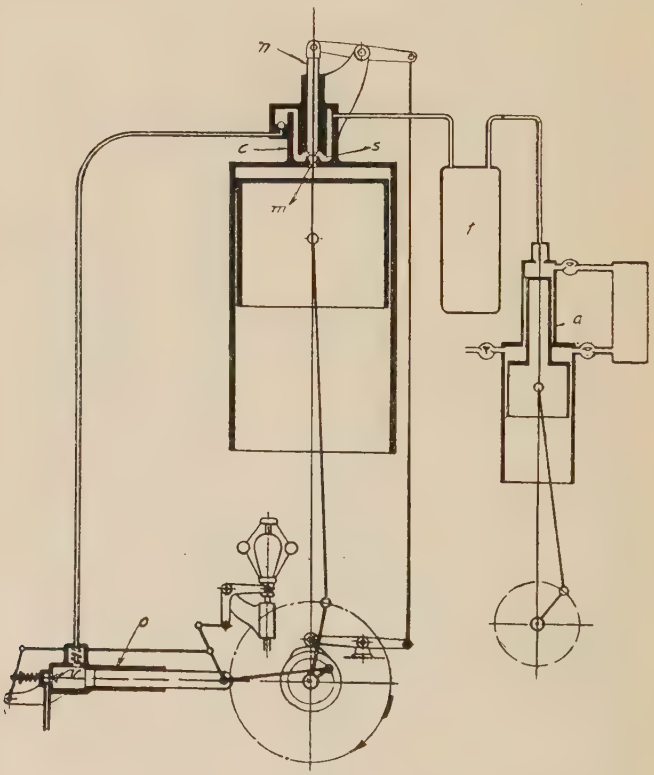


FIG. 5.

of valve *n*. The oil is therefore forced directly into the stream of injection air, the velocity of which is much higher than that of the oil, and the resulting abrupt acceleration of particle for particle of oil produces a complete spray at a minimum expenditure of energy. An important feature of this arrangement is the fact that valve *n* admits the fuel in the form of a very fine, cone-shaped film, thus distributing it equally over the whole surface of the injection air blast. This introduction of the fuel continues until oil pump valve *v* which is under control of the governor, opens, when valve *n* will automatically return to its seat and close off the oil passage, or rather the oil contained therein, from all contact with air until the next injection period begins. The functions of valve *n* are thus three-fold.

1. To determine the velocity with which the oil is to enter space *s*.
2. To distribute equally the oil introduced over the whole surface of the injection air stream.
3. To prevent the possibility of air and oil coming in contact with each other except during the injection period.

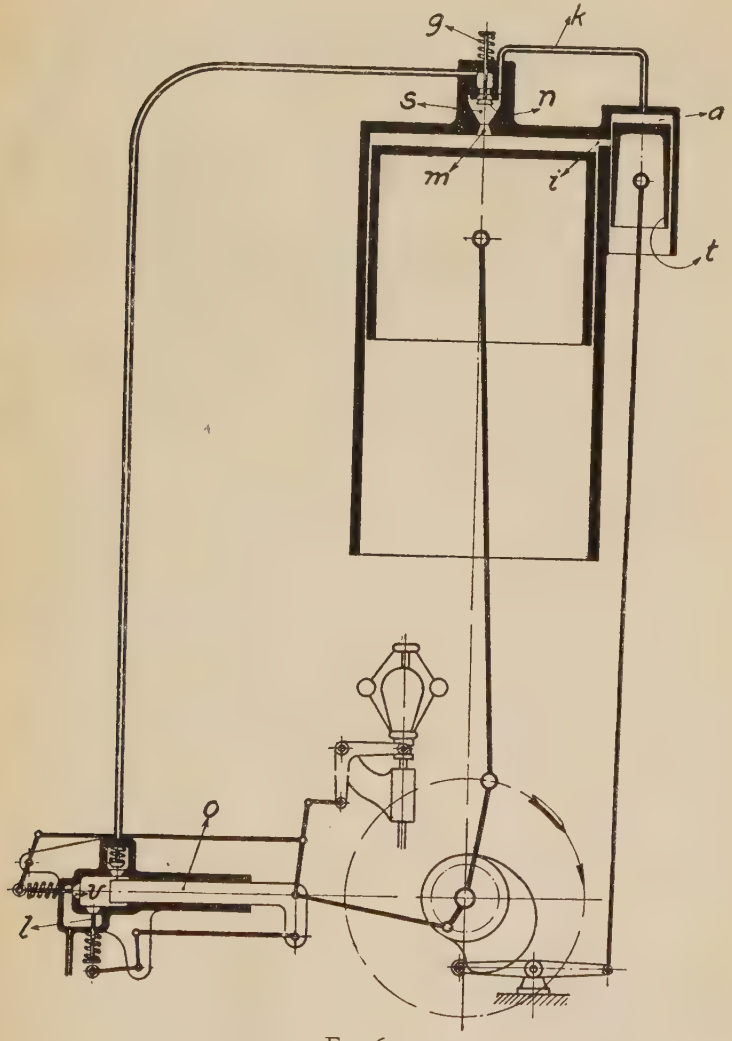


FIG. 6.

It is evident that in this engine the duration of the injection period is determined by the oil pump *o*; provisions must therefore be made to start admission of the fuel under all loads at the same point, relatively, to the position of the main piston. This is accomplished by means of valve *l*, which always closes at a fixed point of the pump stroke when the delivery

of oil begins and continues at a rate determined by the diameter and stroke of the plunger.

This engine is still in the experimental stage but promises to prove its practicability, and represents an engine of surprising simplicity.

DIESEL ENGINES. *Developments on the Continent.* (From an Engineering Correspondent.)—It is rather difficult at the present time for engineers and shipowners to keep fully in touch with all that is being done on the Continent with regard to the development of Diesel engines. The large Continental firms possess an advantage of long experience which it will be almost impossible to wrest from them, but perhaps that is not so important, in taking a wider view of the general aspect of the question, as the lack of knowledge regarding immediate future events which are likely to exercise so great an effect upon all branches of the shipbuilding and engineering industry.

Taking first the subject of the application of the Diesel motor to battleships, in England it is largely a question of vague rumors as to what is being done abroad, and so much exaggerated and impossible news has been circulated as to render it difficult for those who understand the obstacles to be encountered to believe that any actual progress is being made. In reality the position is that at the Nuremberg works an engine of six cylinders, to develop 12,000 horse-power has been designed, the intention being to install it in a large German battleship—not a Russian one as has been stated. The engine has been designed so that each set of three cylinders is self-contained and forms a complete machine capable of working independently; the first set has been constructed and has during the past week or two been running in the shops. So far as can be shown by so short an experience, the results have been satisfactory, and the favorable fact has been deduced that with a six-cylinder engine, instead of the power developed being 12,000 horse-power, some 16,000 horse-power will be obtained with ease—*i. e.*, over 2500 horse-power per cylinder. This engine is of the two-cycle double acting type of the usual Nuremberg construction. It is thus similar to those of 1500 horse-power and 1000 horse-power, which have been built for the Hamburg-America vessel and the Woermann liner.

To turn to another of the chief firms of Diesel engine manufacturers, Messrs. Sulzer Brothers, of Winterthur, Switzerland, it is well known that in this case it has been definitely decided to adhere to the single-acting principle for all Diesel engines. In these works a two-cycle four-cylinder stationary engine of 2400 b. horse-power has completed its trials, while a single cylinder marine engine of 2000 horse-power is now being constructed, also single-acting; all the castings have been made and the engine is at present in course of erection. It will be an entirely independent reversible engine, and will represent the largest power in one cylinder which has yet been built to work on the single-acting principle.

After five years' work on the subject Messrs. Sulzer have now completed a locomotive which is driven by a Diesel engine, and trials are to be begun very shortly. Perhaps in no application of the Diesel motor are the difficulties encountered so great, or the possibilities of economy so high, as in its employment for driving locomotives, and the results of these trials will be watched with great interest.

As indicating the cosmopolitan view which the German Admiralty is taking with regard to the question of Diesel marine engines, it may be mentioned that several German naval engineers have been sent to Messrs. Sulzer's works with the object of gaining a thorough experience in the engines constructed by that firm.

MISCELLANEOUS.

SHORT CUT TO THE PACIFIC.—The steady growth of the fleet-unit for Australian waters which is to form the nucleus of a local navy for the commonwealth, and the progress of the work of making the Panama Canal, proceed side by side in such a way that it may easily happen that Australia will have her orders completed by British shipbuilders at a time that will synchronize with the opening of the Panama Canal to maritime traffic. That this artificial waterway will be used freely by our merchant ships and warships, goes without saying, and if it is to be neutral in time of war it will make it much easier for our Colonial fleets to join hands with the mother fleet, as well as facilitate reinforcements being sent to many parts of our empire which will then be much less remote in point of access from our shores, than at present. The Pacific will, in fact, be brought within reasonable touch with our home fleets, and Australians may well feel a greater security after the new waterway is opened. The difficulties in the making of this canal have been stupendous; but the tenacity of the American statesmen and engineers has surmounted all obstacles, and the end is now plainly in sight; they are to be congratulated on the way their modern De Lesseps, Colonel Goettral, has stuck to his task and placed the accomplishment of such a creditable performance beyond all reasonable doubt. In the old days, a commission on the Pacific station often meant four, five or even six years in duration for British warships, owing to its remoteness. In three years' time the Panama Canal will be finished and the Pacific will be accessible in little more than a fortnight from England.—*United Service Gazette.*

THE GENERALSHIP OF ARMED MILLIONS.—The recent tension over Morocco has given rise to some extraordinary theorising in military circles, regarding the employment of enormous masses of troops in the field. The trend of thought in Germany at the present moment is to throw the whole of the able-bodied male population into the field, as one huge fighting machine, and as, according to recent statistics, this would mean the handling of about 1,380,000 men, it is impossible to conceive such a force as acting under a one-brain impulse. We are of opinion that our own regular army, as at present constituted and controlled, would be quite able to act successfully against even so gigantic a force as the above, providing always that we have an ally as a containing factor in the military problem. Our strategists will make a great mistake if they follow, as they have so frequently and foolishly done in the past, all the wild-cat theorising that emanates from the Continent. Far better that we should adhere closely to our own common-sense ideas, and thus retain what in the past has frequently been a pillar of strength to this country in times of great conflicts, than copy foreign methods that have so often proved disastrous. It is absurd to talk of armies of a million and a half, all engaging at one time over a frontage of some three or four hundred miles, and we are surprised that so much attention is being paid to these vaporings. It should be remembered that there are certain necessities such as food, ammunition, and medical arrangements, required for the maintaining such a force; but what is more pertinent, is the fact that any commander who followed on the strategy of Moltke, would, with ordinary care, be able to dismember such a huge army at several points at the same time, and thus render the colossus impotent.—*United Service Gazette.*

AEROPLANES IN THE FRENCH MANEUVERS.—The *France Militaire* gives admission to an article concerning the use of aeroplanes in the maneuvers in Eastern France, which is calculated to bring the conception of the value of these craft into right proportions. The writer admits that the subject is delicate, but he asserts that imagination plays a considerable

part in estimating the value of the aeroplanes. He knows that these craft have astonished us, and are likely to astonish us much more. There can be no doubt of the boldness and courage of the pilots, and too much can scarcely be asked from them. Their duties are great and important, and they have the high courage of enthusiasm. The aviators have captured the public imagination, but the young pilots must not be flattered into thinking that they can win battles, as the artillery used to think. The writer in the *France Militaire* has studied the services of the aeroplanes minutely, and says that, instead of asserting that they have won battles, it would be well to ask if and how they could assist to win them. The latter is the point that has to be considered in the future. Their object is to dicover the situation of the enemy, but information is good and bad, the good being that which influences the decision of the chief. Cavalry officers have spent long years in learning how to gather this useful information, and yet they do not always possess the confidence of their chiefs. Is it to be imagined that the commander of an army or an army corps on the field of battle will accept with blind faith the information brought by an aviator. His personal responsibility is likely to forbid this. In maneuvers, operations are undertaken on the receipt of relatively doubtful information, but the same is not the case in war. In short, the critic thinks that aviators have yet to gain the confidence of their chiefs, and not to exaggerate their functions.—*Army and Navy Gazette.*

CONTRACTORS' CLAIMS.—It seldom happens that on public works carried out by contractors that the final accounts are agreed and settled up without any claims for extra payment under some head or other.

Claims may be made on account of alleged deviations from the contract during the progress of the work, or in respect of extra cost incurred by the contractors above that anticipated, due to alterations on the part of the engineer, or to difficulties and delays encountered which may or may not, have been beyond the control of the contractors. The form of contract and specification, if properly drawn, may, if strictly enforced, cover the employer's alleged liability, and place the whole onus on the contractors. Sometimes claims put forward by contractors are largely frivolous and vexatious, and are raised merely in the attempt to get as much out of the employers as possible. The contract may not have been remunerative, and an endeavor is made to finally come out on the right side, to a greater or less extent, by what can be got out of claims, often irrespective of the real merits of the case. There are contractors who, from the start of work, make it a special business to raise or manufacture claims on every conceivable opportunity, whether these can or cannot be substantiated wholly or in part. As a rule contractors' claims may be classed generally as follows:

1. Claims arising out of alleged alterations or non-fulfilment of the contract through no fault of the contractors.
2. Claims on account of delays or difficulties beyond the contractors' control.
3. Claims arising from alterations made as the work proceeds.
4. Claims made in the attempt to cover losses due to the contractors' mismanagement, oversights, or bad luck.
5. Indirect claims, or claims for consequential damages.
6. Frivolous and vexatious claims.
7. Petty claims.

Nearly all contracts give rise to some or all of the claims falling under the above heads. They may be further roughly sub-divided into:

1. Claims which the resident engineer cannot settle, and which should obviously be left to the arbitrator.
2. Claims the resident engineer should settle, if a reasonable settlement can be made.

3. Claims which only the resident engineer can and should settle, and which ought never to be carried to a higher authority.

4. Claims which ought never to have been made.

It is probable that under each division there may be items which ought to be withdrawn, which the contractors, if fair and reasonable, will readily withdraw. At the same time matters not infrequently arise in which the contractors are fairly entitled to some consideration which the resident engineer or immediately responsible official will not or cannot see. Some people are unable to see two sides of a question; some will haggle over pence and miss pounds.

A mistake often made on public works is the deferring of the settlement of many trivial matters, involving small sums of money, for months or even until the completion of the contract. Those on both sides of the fence are frequently equally to blame—neither side will budge. Of course, an important principle may be involved in a matter of small moment monetarily, and in this case it may be necessary and wise to delay settlement. A certain amount of the spirit of compromise over matters in dispute or differences of opinion arising during the progress of works is often equitable and needful. A delay in final settlement until the heat of argument has passed away may be judicious and wise.

Nevertheless the number of small and trivial matters held over until the end on many contracts becomes almost an absurdity. Contractors with an undue appetite for claims are inclined to prefer delay in order thereby to confuse the issue and so hope for an advantage. Moreover, time is a great softener, and by long delay many small matters which assumed comparatively great importance cease to do so, and thereby this class of contractor may obtain eventually what he is not really entitled to. These matters should, as far as possible, be settled up as the work proceeds, full particulars being kept of all items not agreed or withdrawn, so that the lapse of time shall not militate unfairly against either party.

On questions of fact no doubt can arise if the engineer's and contractors' representatives know and attend to their business. It is a good plan when a claim arises, or is likely to be made, for both sides to agree upon the facts and on the work done in those cases which are deferred or left to higher authority, so that when the principle involved is decided, there can be no doubt as to the basis of settlement or the amount fairly at stake.

To carry out work well, confidence in each other on the part of the resident engineer and contractors' representatives is essential. Neither should be seeking an advantage over the other. The contractors are, of course, there to make money, but to do so squarely and honestly under the contract. The engineer is there to watch the interests of the employers, to see fair play, to get fair work for fair payment under the contract and specification, and to render all reasonable assistance to achieve the speedy and satisfactory completion of the work.

A specification properly written endows the engineer with great powers. It is intended to give him the whip hand if required, and it sometimes is required. On the other hand, specifications are usually meant to be applied with reason and judgment, not losing sight of the principles of equity between decent and honorable men.

Day work is a fruitful source of dispute between engineers and contractors. In the hands of some contractors, it is not putting it too strongly to say that day work amounts to daylight robbery. This method of working should not be adopted unless circumstances render it unavoidable. It not infrequently happens that work has to be done for which no item appears in the schedule, or to which no schedule item can be fairly applied. Whenever possible, prices should be agreed upon between the engineer and the contractors. If the resident is a confident and strong man, this course can usually be adopted. As a rule, a resident is not empowered to alter a schedule rate, but he can, if in the position and exercising the authority

which ought to be his, make a new price, within limits, to meet particular circumstances not previously provided for. The contractors may decline to accept a price which the resident knows is a fair one and hold out for a too high a rate, or press the alternative of day work. The latter course is often pressed, but if the resident engineer is satisfied the work can be fairly done without recourse to day work, he may decline to allow it, and pay a price on account, leaving the final settlement until later. In this case he would naturally take care that the payment on account was not too high.

Some resident engineers are very loath to settle prices, readily taking refuge in day work. It is perhaps less trouble, and by doing the work on the basis of time and material, he imagines he is getting rid of responsibility. The clerks of works or others can be instructed to return the time, and as long as there is a return, showing so many men so many hours, it matters little what the work is costing. The resident certifies for it, and takes refuge in the returns. It is common knowledge that when work is done and supervised, as a good deal is, in this manner the cost is often higher than it should be, and a longer time taken to complete it. A resident engineer who acts in this way is either partially ignorant or inefficient.

There are many causes which militate towards unnecessary cost in the execution of public works. It is sufficient to say here that one reason which tends towards the line of least resistance is that it sometimes happens the final accounts are subject in full detail to the review and scrutiny, as to prices and everything else, of an accountant's staff. These persons are very competent accountants, *qua* accountants, but are not engineers, and know nothing of the value of the work. It is as easy as A, B, C for a man who knows his way about to drive a coach-and-four through these people. Consequently, if a price is arranged, not being in the schedule, long, tedious and irritating explanations are asked for. Whereas, so long as hours, men and material appear in the accounts, the money checks out at schedule rates, and nobody asks why a job has cost 300*l.* which might, and probably ought to, have been done for 200*l.* Moreover, it sometimes happens that a certain sum has been sanctioned by a committee, and if the money be not spent, it is almost as awkward, in a sense, as having to ask the committee for an extra sum. If this happens, the resident may get a little more credit with his head office for saving than he loses if increased expenditure is incurred. Either the system or the committee are to blame for this. In any case, the tendency is opposed to economy.

A source of trouble with contractors' claims lies in the fact that even where a *bona fide* claim exists the amounts at first asked by so many contractors are nearly always considerably in excess of anything that can be reasonably substantiated. In fact, the total is a good deal higher than is expected or hoped will be allowed. It is made up in order to bear substantial reduction. Unfortunately, human nature is largely responsible for this mode of doing business, which is to be deprecated. Swollen claims become a part of the stock-in-trade of claim-seeking contractors. They wish to obtain all that is possible, not much minding how they get it. On the other hand, engineers are in some measure responsible for this custom, so frequently resorted to, of making up outrageous claims.

The idea fixed in the minds of many engineers (we do not refer to those acting in the capacity of arbitrators) is that contractors' claims, whatever the amounts and whatever the argument upon which they are based, must be substantially reduced. The merits of the case are lost sight of so long as a settlement can be reached at a figure well below the original claim. The engineer is anxious for a good reduction, and the smaller the proportion of the amount claimed for which he can settle the better he is pleased. Contractors know this. They soon learn to know the man they have to deal with, and make up their claims accordingly. At the same time, everybody knows many engineers who possess the faculty of distinguishing reasonable claims and settling matters fairly

on their merits, having, of course, due regard to contracts and specifications. With such men it generally is to the contractors' advantage to confine claims to reasonable proportions, which can be substantiated both in principle and amount, rather than to ask for 200*l.* and be quite ready when pressed to accept, say, 75*l.*, or nothing at all.—*Engineering.*

THE NAVY AND SCIENCE. *Admiral Sir A. Moore's Reminder.*—At the concluding meeting of the British Association at Portsmouth, the thanks of the association were extended to the mayor and corporation, and to the commander-in-chief (Admiral Sir A. Moore). The vote of thanks to the commander-in-chief was proposed by Sir William White, who said the members of the association had found even more than they had anticipated to interest and instruct them.

Admiral Sir A. Moore, in reply, said the navy was very glad to have had the opportunity of entertaining the thinking men, the men of science, for they profited so much from their researches. Men of science provided them in war time with facilities for quick destruction. They read a great deal about *Dreadnoughts,* and they had seen some of the submarine and torpedo-boats in actual working order. The material was, of course, very important, but at the same time, what was of far greater importance was the men who had to man the ships. They might design and build the most efficient vessels, but what good were they if they had not good men to man and make the most of them? Here, he feared, we were tending to fall into error. Certainly we lived in days of science, and we must keep apace with the latest discoveries, but we must never forget that when the day of battle came they depended mostly upon the men. They must not think that beginning and the end of the training of the officer was the knowledge of scientific machinery, but the development of the characteristics required in time of war, and he felt rather strongly that we were perhaps somewhat apt to ignore that undoubted fact.—*Naval and Military Record.*

It has been repeatedly urged that America should be kept out of calculations of the two-power standard. In the first place the inclusion of the American fleet would be politically unwise, and secondly, there is every reason to anticipate that for some years to come ship construction on the other side of the Atlantic will be limited. In the article which he has just contributed to *The Atlantic Monthly* upon the present position and prospects of American naval power, Sir William White adopted this attitude towards the effort to drag America into our naval discussions. Sir William White made no comparison between the British and American navies, and he explained he had taken this course advisedly because he was one of those, happily a large and ever increasing number in both countries, who regard the question of war between the great English speaking peoples as lying beyond the region of probability and therefore requiring no discussion. As Sir William White pointed out, the recent satisfactory settlement at The Hague of the only important differences which existed between the two countries emphasizes this belief. Both countries share the desire for the maintenance of an "open ocean," across which commerce and communications can proceed in safety; of an "open door" for the entry of their manufactures into the great markets of China; and their supreme interest is centered in the maintenance of the peace of the world. By united action it lies in their power to insure the continuance of peace to an extent which is possible to no other combination of powers, and they wish to attain that desirable result without injury to the interests of other nations. In these circumstances the late director of naval construction, who for so many years has been in intimate touch with the American naval authorities, gave it as his deliberate opinion that it was not only undesirable, but useless, to make comparisons of the relative naval strength of Great Britain and the United States.—*Naval and Military Record.*

REAR-ADMIRAL N. C. TWINING, U. S. Navy.—The attention of the Bureau of Ordnance, Navy Department, has been drawn to a statement made by Dr. Charles E. Munroe in a paper read before the Interantional Congress of Applied Chemists, in London, 1909, to the effect that provision had been made to rework U. S. navy smokeless powder every three years. This statement has tended to create an erroneous impression, particularly abroad, and to cast an exaggerated and unwarranted suspicion on American powder, which it is desired to correct.

To understand the situation clearly, it is necessary to state that smokeless powder for the U. S. army and navy is made under government specifications prepared by a Joint Board of Arm and Navy Officers from results obtained after years of experimentation and exhaustive tests by ordnance and chemical experts. Every effort has been made to improve the process of manufacture and the bureau can state positively that the powder as now manufactured will, under normal conditions of storage, enjoy a life of from twelve to fifteen years, and possibly longer.

The bureau now has powder in service which is from seven to twelve years old and which is still in excellent condition as to stability; this powder was manufactured before certain improvements in the process of manufacture now in vogue were adopted; these improvements render certain a longer life of powder into the manufacture of which they have been introduced.

The bureau has established a reworking plant for the purpose of reworking such powder as may prove unsatisfactory; by the use of this process powder which it is necessary to condemn for any reason can be made over into new powder of the best quality at a small cost instead of being a total loss.

At about the time Dr. Munroe was preparing the paper above mentioned the bureau made marked improvements in the process of manufacture of smokeless powder by the introduction of a stabilizer. This has been acknowledged by Dr. Munroe as will be seen from the following copy of his letter on October 6, 1911, to Mr. H. F. Brown of the Du Pont Powder Company, which is published by the kind permission of Mr. Brown and Dr. Munroe:

EIGHTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, WASHINGTON AND NEW YORK, SEPTEMBER, 1912.

October 6, 1911.

Mr. H. F. Brown, Director Smokeless Powder Department, E. I. Du Pont de Nemours Powder Company., Wilmington, Del.

DEAR SIR: Replying to your inquiry regarding the statement made in my London paper in 1900, viz. "To insure stability, provision is made for reworking the powder every three years" I state that such frequent reworking of the powder has not been found necessary even with the older form of powder and that moreover, while my paper was being published, such improvements were made in the manufacture and stabilization of the U. S. powder referred to as to greatly improve its keeping qualities. The experience of the users of this powder and the results of the tests made indicate that the powder as it is now and has been made for some years will enjoy a life of from twelve to fifteen years and probably longer.

Yours very truly,

(Sd.) CHARLES E. MUNROE.

THE HYDRO-AEROPLANE FOR THE NAVY.—The success of Lieuts. T. Gordon Ellyson and John G. Towers in flying in a hydro-aeroplane down Chesapeake Bay from Annapolis to Buckroe Beach, Va., a distance of 145 miles, in 147 minutes, will justify Secretary Meyer in asking Congress in December for a liberal appropriation to equip the navy with airships of the amphibious class.

When the Secretary wrote his report a year ago, Mr. Eugene Ely had recently (on November 14) made a flight in a Curtiss biplane from a temporary platform on the forward deck of the scout cruiser *Birmingham*, and Mr. Meyer said in his report.

"The Department contemplates further experiments along these lines, with the belief that it will be necessary in the near future to equip all scouts with one or more aeroplanes to increase the distance at which information can be secured."

A hydro-aeroplane is an aeroplane fitted with attachments to facilitate the starting of the airship from the surface of water and its alighting on the same element. A Frenchman, M. Henri Fabre, was the pioneer of amphibious locomotion, making the first flight at Martinique on March 20, 1910. Mr. Glenn Curtiss had begun to experiment on Lake Keuka the previous year, but it was not until January 26-27, 1911, that in San Diego Bay he rose from the water, and after taking his course through the air settled down again on the surface of the bay with the ease of a gull. His hydro-aeroplane developed a speed of forty-five miles an hour on top of the water, and in the air it traveled fifty miles an hour.

On February 27 Mr. Curtiss flew from North Island to the side of the cruiser *Pennsylvania*, and the airship was drawn up from the water and placed on the forward deck, as if it were an auxiliary for scouting purposes. A week later Lieut. T. Gordon Ellyson was taken up with the aviator for a flight of one and a half miles at a speed varying from twenty-five to fifty miles an hour, Lieutenant Ellyson sitting on the pontoon rigged below the aviator's seat. From this position Lieutenant Ellyson could see bottom at a depth of twenty-five feet, and he afterward said that in clear water it would be possible to see from the hydro-aeroplane a submarine traveling under the surface. It was also the lieutenant's opinion that when the airship was moving at the comparatively slow speed of twenty-five miles an hour bombs could be dropped with precision from the pontoon.

Mr. Curtiss began his experiments at San Diego by attaching to his lower plane, at about the center, a float six by five feet and one foot thick, arranged at an angle of ten or twelve degrees. In front of this, about the place of the wheel in a land machine, he attached another float six feet wide, one foot from front to rear and six inches in depth, and ahead of that float he fixed a small elevating hydro-plane. He found the combination too cumbrous and substituted a single float twelve feet long by two wide with a depth of twelve inches, resembling a scow, curved upward at the bow and downward at the stern. The weight was only fifty pounds. Thus equipped the aeroplane ran over the surface of the water with hardly any disturbance and rose into the air quickly and smoothly.

As Lieutenant Ellyson became Mr. Curtiss's pupil the presumption is that the hydro-aeroplane used on Chesapeake Bay had the equipment which we have described. In one account of this remarkable flight by two men on land and water, which has never been equalled, it is said that near Buckroe Beach "the engine was stopped and the big hydro-aeroplane was allowed to settle on the water," and that then "the gear was changed to the propeller shaft and the machine was run ashore." Apparently enough speed was attained to drive her up on the sands. It is to be noted that a strong east wind prevailed during the trip along the west shore of Chesapeake Bay, and that the machine was sometimes flying seventy miles an hour.

It is obvious that the hydro-aeroplane could not take to the water when any kind of a sea was running. In the present stage of development it is a craft for use on inland waters or on bays when the surface water is not rough. Nevertheless, the value of the hydro-aeroplane as an auxiliary to naval vessels for reconnoissance and for conveying despatches, and for light transportation both in peace and war, cannot be seriously disputed. Its employment for damaging or destroying an enemy's ship with explosives may still be debatable.—*New York Sun.*

BOOK NOTICES.

"Submarines of the World's Navies." By Charles W. Domville-Fife. Published by J. B. Lippincott Company, Washington Square, Philadelphia, Pennsylvania.

The author ably outlines in his preface to this attractive, well illustrated and well arranged book, the field he endeavors to cover; he says "In the description of the submarine torpedo boats of the various naval powers, it has been the object to point out the differences of the vessels, types and clases; with the purpose of showing their fighting value and efficiency, and of giving an idea of their construction, without occupying undue space, or wearying the non-technical mind with the description of details which are common, in one form or another, to every submarine boat."

This book has the fault, an unavoidable one in any publication descriptive of so rapidly developing and changing a subject, of being some months behind the newest developments, and consequently is of little value to the naval expert. Its information, however, seems to be accurate up to about the last of the year 1909, and will enable the lay reader to obtain a good comparative idea of the attitude of the world's navies toward this newest type of craft, and of their progress in its development.

The brief communications in Part III, from some of the world's authorities on the subject, give the reader a correct impression of the true value and possibilities and also of the limitations and dangers, of this type of craft as seen by their designers and commanders.

The book is well written and extremely readable, and will doubtless prove itself interesting to a large section of the American public, as it treats of an up-to-date subject about which comparatively little has been published, and which has been surrounded with an air of mystery which is, unfortunately, not wholly dispelled by the present writer.

R. H. Danforth.

"Studies, Military and Diplomatic, 1775-1865." By Charles Francis Adams; The Macmillan Company. Contents. *Military Studies.* The Battle of Bunker Hill. Battle of Long Island. Washington and Cavalry. The Revolutionary Campaign of 1777. The Battle of New Orleans. The Ethics of Secession. Some Phases of the Civil War. Lee's Centennial. *Diplomatic Studies.* An Historical Residuum. Queen Victoria and the Civil War.

A splendid work. The author is evidently on familiar ground, and the completed volume shows both familiarity with and careful study of the subjects under consideration. Facts and deductions therefrom are presented in a pleasing and delightful manner. The illustrative battles and military subjects are happily selected, making a book that must be of interest to the American people. To the military student this work will be of inestimable value and fulfils a long felt want.

The Diplomatic Studies must be of great interest to all patriotic Americans, dealing as they do with the greatest crisis in the history of our great

republic. The book is pleasing and instructive, and after careful reading one regrets that there is not more.—Price, $2.50 net.

D. W. WURTSBAUGH.

"A Handbook of Wireless Telegraphy." J. Erskine Murray, D. Sc. (third edition, 1911): D. Van Nostrand Co.; $3.50.

This book is written in a popular, and, for the most part, non-mathematical style, and will prove exceedingly interesting to those who have some slight knowledge of wireless telegraphy. In addition it will be of use as a work of reference to the specialist inasmuch as the author has gathered together accounts of many types of comparatively little known apparatus and many interesting experiments which, up to the present time, have been described only in scattered articles in the technical journals. In the descriptions of the different so-called systems the author has quite naturally taken the statements of the manufacturers for the attainments of their systems. These, of course, will be taken with a grain of salt. In such cases the distances given as having been covered by the appartus are usually made at night which, as is now known, gives no criterion of the excellence of the apparatus. The book contains a brief history of the development of wireless telegraphy, including the early attempts at signaling without wires, which led up to wireless telegraphy itself. A brief account is given of various systems, the lesser known being described almost as completely as those which have a wider use. A curious omission in this particular is the failure to describe the present Telefunken quenched spark apparatus. Among the interesting experiments described are those of Duddell and Taylor with the steamer "Monarch" on the variation of received current with the distance. Attention is also given to the experiments of Captain Wildman in Alaska on the measurements of received current. These were among the first attempts to apply quantitative methods to wireless telegraphic transmission.

The following list of the chapter headings will give a good idea of the material covered in the book: I, Adaptations of the Electric Current to Telegraphy; II, Earlier Attempts at Wireless Telegraphy; III, Apparatus Used in the Production of High Frequency Currents; IV, Detection of Short-lived Currents of High Frequency by Means of Imperfect Electrical Contacts; V, Detection of Oscillatory Currents of High Frequency by Their Effects on Magnetized Iron; VI, Thermometric Detectors of Oscillatory Currents of High Frequency; VII, Electrolytic Detectors and Crystalline Rectifiers; VIII, The Marconi System; IX, The Lodge-Muirhead System; X, The Fessenden System; XI, The Hozier-Brown System; XII, Wireless Telegraphy in Alaska; XIII, The De Forest System—thePoulsen System—the Telefunken System; XIV, The Lepel and Other Shock-excitation Systems; XV, Directed Systems; XVI, Some Points in the Theory of Jigs and Jiggers; XVII, On Theories of Transmission; XVIII, Wave-wave Telegraphy; XIX, Adjustments, Electrical Measurements, and Fault Testing; XX, On the Calculations of a Syntonic Wireless Telegraph Station; XXI, Tables and Notes; Appendix, Radiotelegraph Convention Service Instructions.

L. W. AUSTIN.

"Internal Combustion Engine Manual." By F. W. Sterling, Lieutenant, U. S. N., School of Marine Engineering, U. S. Naval Academy.

A treatise on internal combustion Engines written primarily as a text book for midshipmen. The time allowed for this course is limited to about twelve lessons, hence the subject is very briefly treated.

In the foreword the author gives the following information:

"(a) The subject of fuels is first treated fully, this being the fundamental element that governs design and operation. These fuels follow in a natural sequence which order is preserved when carburetion is taken up in Chapter V.

"(b) The engine proper naturally divides itself into four systems: (1) fuel system, (2) ignition system, (3) cooling system, (4) lubrication system. These are treated in detail in the above order and in Chapter X the four systems assembled are illustrated by modern commercial engines.

"(c) Producer plants being closely allied to gas engines are given a short chapter at the end of the book."

2. The author describes the details of construction of the various parts of the engine in Chapter III, and in the next chapter explains the principles of action of the two- and four-cycle types. A more logical arrangement would be made if these subjects were treated in the reverse order.

In the early part of the text the heat balance of an internal combustion engine, and of a steam engine plant are very cleverly diagrammatically compared, and these two forms of motive power are generally compared. This should come later in the book, perhaps in the chapter that treats of the thermal efficiency of the engine.

With the above exception, the book is logically arranged, and more meat is given than in many other books of much larger size.

3. In the chapter on fuel systems only one of each type of caburetor is described. These are well selected, showing the difference in design required by the different fuels; and embody the principles of all carburetors.

The sketches of electric spark ignition being diagrammatic are very easily understood.

In the chapter on faults, the usual defects and their remedies are given.

There are well selected sketches, and brief descriptions of the various types of commercial engines including the Gnome engine for aeroplanes and the Knight engine for automobiles. It is to be regretted that the author did not go more into the subject of heavy oil engines, as it is a live subject, especially for marine engineers.

The various types of gas producers are described. Diagrammatic and detailed sketches to explain principles of operation and assembled drawings of modern plants are included.

The book is recommended to all officers preparing for examination or who find their duties will require them to know something about this subject.

The volume contains 145 pages, 4″ x 7″, and copies can be purchased from the author or through the Secretary-Treasurer of the Naval Institute; price, $1.75.

W. B. WELLS.

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U. S. N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896.

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U. S. N.

1897.

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U. S. N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U. S. N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U. S. N.

1900.

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U. S. N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U. S. N.

1901.

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U. S. N.

1903.

Gunnery in Our Navy. The Causes of its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U. S. N.

A NAVAL TRAINING POLICY AND SYSTEM. Honorable Mention, 1903. By Lieutenant James H. Reid, U. S. N.

SYSTEMATIC TRAINING OF THE ENLISTED PERSONNEL OF THE NAVY. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U. S. N.

OUR TORPEDO-BOAT FLOTILLA. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U. S. N.

1904.

The Fleet and Its Personnel. Prize Essay, 1904. By Lieutenant S. P. Fullinwider, U. S. N.

A PLEA FOR A HIGHER PHYSICAL, MORAL AND INTELLECTUAL STANDARD OF THE PERSONNEL FOR THE NAVY. Honorable Mention, 1904. By Medical Inspector Howard E. Ames, U. S. N.

1905.

American Naval Policy. Prize Essay, 1905. By Commander Bradley A. Fiske, U. S. N.

THE DEPARTMENT OF THE NAVY. Honorable Mention, 1905. By Rear-Admiral Stephen B. Luce, U. S. N.

1906.

Promotion by Selection. Prize Essay, 1906. By Commander Hawley O. Rittenhouse, U. S. N.

THE ELEMENTS OF FLEET TACTICS. First Honorable Mention, 1906. By Lieut.-Com. A. P. Niblack, U. S. N.

GLEANINGS FROM THE SEA OF JAPAN. Second Honorable Mention, 1906. By Captain Seaton Schroeder, U. S. N.

THE PURCHASE SYSTEM OF THE NAVY. Third Honorable Mention, 1906. By Pay Inspector J. A. Mudd, U. S. N.

1907.

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A few thoughts on our next step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut.-Comdr. Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908.

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENSE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut.-Commander Yates Stirling, U. S. N.

1909.

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910.

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotten, U. S. N.

1911.

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its thirty-eighth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary, and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing."

The Proceedings are published quarterly and anyone may subscribe for them. The annual subscription is $3.00; single copies, 75 cents. Annual dues for members and associate members, $2.00. Fee for life membership, $30.00.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1912.

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1912. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either typewritten or copied in a clear and legible hand.

9. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

W. B. WELLS,
Lieut.-Commander, U. S. N., Secretary and Treasurer.